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PROCEEDINGS

OF THE

ENTOMOLOGICAL SOCIETY

OF

WASHINGTON.

Volume II.

1890–1892.

WASHINGTON, D. C.:
Published by the Society.
1893.

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Publication Committee for Volume II.

C. L. MARLATT. E. A. SCHWARZ. L. O. HOWARD.

B: PICKMAN MANN. NATHAN BANKS.

M. L. LINELL.

PROCEEDINGS

OF THE

Entomological Society

OF

WASHINGTON

Volume II., No. 1
(JANUARY 9th, 1890, to DECEMBER 4th, 1890.)

WASHINGTON, D. C.:
PUBLISHED BY THE SOCIETY.
1891.

Press of Gedney & Roberts
Washington, D. C.

Entomological Society of Washington.

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‡ ASHMEAD, W. H., 1889–90.
AUSTIN, AMORY, 1891– .
BANKS, NATHAN, 1890– .
* BARNARD, W. S., 1884–85.
‡ BRUNER, L., 1884–85.
DODGE, C. R., 1884– .
FERNOW, B. E., 1890– .
FOX, W. H., 1887– .
HEIDEMANN, O., 1885– .
HOWARD, L. O., 1884– .
KUEHLING, J. H., 1887– .
LACY, R. S., 1884.
LINELL, MARTIN L., 1889– .
‡ LUGGER, O., 1884–89.
MALLY, F. W., 1890– .
MANN, B. P., 1884– .
MARLATT, C. L., 1889– .
MARX, GEO., 1884– .
† MORRIS, J. G., 1884–90.
† MURDOCK, J., 1884–85.
OERTEL, T. E., 1884–88.
PERGANDE, THEO., 1884– .
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SCHWARZ, E. A., 1884– .
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† SHUFELDT, R. W., 1884–89.
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STEWART, A. H., 1884–86.
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UHLER, P. R., 1884.

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ASHMEAD, W. H., 1891–
ANGELL, G. W. J., 1890–
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BRUNER, L., 1888– .
CASEY, T. L., 1884– .
* ELLIOT, S. L., 1889.
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SHERMAN, J. D., JR., 1886– .
SMITH, J. B., 1889– .
WEBSTER, F. M., 1890– .
WENZEL, H. W., 1890– .

* Dead. † Resigned. ‡ Transferred to **Associate Membership List.**

PROCEEDINGS

JANUARY 9TH, 1890.

Nine persons present. President Schwarz in the chair.

Mr. H. W. Wenzel, of Philadelphia, was elected a corresponding member.

The election of officers for 1890 resulted as follows:

President, George Marx; 1st Vice-President, C. V. Riley; 2d Vice-President, L. O. Howard; Recording Secretary, C. L. Marlatt; Corresponding Secretary, C. H. Tyler Townsend; Treasurer, B. P. Mann; Members of Executive Committee, E. A. Schwarz, Otto Heidemann, Wm. H. Fox.

The retiring President delivered his Annual Address:

ANNUAL ADDRESS OF THE PRESIDENT.

NORTH AMERICAN PUBLICATIONS ON ENTOMOLOGY.

BY E. A. SCHWARZ.

Since the year 1876 we have witnessed or taken part in the celebration of several centennials—the Centennial of the Declaration of Independence, the Yorktown Centennial, the Washington Inauguration Centennial, and others—all in commemoration of the political birth of the American nation. But I have never read nor heard that, during this time, the American entomologists have celebrated the centennials in their own science. In the year 1880 we should have remembered that two hundred years ago the first paper on insects was written in America, viz: John Banister's "Some Observations concerning Insects, made in Virginia, A. D. 1680," which was published, with remarks, by Petiver, in 1701, the paper being written before the modern conception of scientific research, and therefore only of historical interest. On July 27, 1887, we

should have commemorated the one-hundredth anniversary of the birthday of Thomas Say, who was the first to make a determined effort to create an American literature on American insects. It is just a hundred years ago that the first scientific collections of insects were made by Peck and the older Melsheimer, many of the insects from the latter collections being still preserved. Above all our American scientific literature on insects is now about one hundred years old. To whom the honor belongs of being our first entomologist depends largely upon individual opinion. William Dandridge Peck, who commenced to write in 1795, was, no doubt, our first scientific entomologist: but the various articles on insects by the few earlier authors, and notably by Barton, the Bartrams, and others, are by no means inferior in scientific character—but their authors cannot be called entomologists. This centennial of our literature should not be celebrated by a centennial speech simply praising the great progress made within a hundred years, but by giving a full history of American Entomological Science. And such history is a desideratum ; "for the knowledge of the evolution of a science is to the student of the same importance as to the architect a thorough knowledge of the foundation upon which he intends to erect his building." To be sure we have a history, viz : the "Contributions toward a History of Entomology in the United States," by our fellow member and senior of American entomologists, Dr. J. G. Morris, read before the National Institution in 1844 ;* but, although containing many interesting facts, this history was written at a time when the study of entomology was at very low tide in this country and when many data regarding literature and entomologists were still unknown.

American Entomology offers a most inviting field to anyone who is willing to write its full history. It should explain the reasons why in the earliest time entomological science was cultivated here so much later than Botany, Ornithology, Ichthyology and other branches of natural history ; it should point out how this neglect resulted in a long period when American

* Published in Silliman's Jour. Am. Arts and Sc., 1846, pp. 17–27.

Entomology was in utter dependence upon European writers; it ought to extol the struggles—timid at first but gradually becoming bolder and more and more successful—of a whole generation of American writers to throw off this slavery, until we come to a time when American insects can be studied from American literature, and where at least one branch of American entomology has attained a state of perfection which is not paralleled in any other country.

I am by no means competent to undertake such work, nor could it be presented in a short address, except in the most general outlines; and I have contented myself with an exceedingly modest and insignificant part of such history, viz: to enumerate the various ways in which the American contributions of one hundred years to entomological science have been presented to the public.

The oldest, and, taken as a whole, most satisfactory way of presenting to the public the results of scientific research is in the form of separate books published and sold through the regular book trade. Since this mode of publication is a commercial enterprise on the part of the publisher, or has to be done at the expense of the author, it is not surprising that with the few entomologists in the earlier part of this century the number of separate books is exceedingly small. The very first book exclusively devoted to North American insects is that which goes by the name of Smith & Abbot on the Lepidoptera of Georgia, printed in 1798, but this was published in England. The first book on insects ever published in America is the Catalogue of the Coleoptera of Pennsylvania, by the older Melsheimer, in 1806, if this little pamphlet may properly be called a book. From that year we have to go down to 1824 to find the next work, viz: Thomas Say's well-known "American Entomology," of which three volumes were published between 1824 and 1828.* This is, in reality, the first great work produced in America by an American entomologist. From this work to the next there is another interval of more than ten years, for I fail to find a separate book

* A few copies of a portion of the first volume were printed in 1817.

on insects before the year 1839, when Dr. Nathaniel Potter published, in Baltimore, a small book on the Periodical Cicada.* The publication of the great work on North American Lepidoptera, by the older Leconte, in conjunction with Boisduval, was commenced some years previously, but it was printed in France. But even counting in this and Abbot's work, we find that up to 1840 only seven books treating on North American insects were published, and this small number strikingly contrasts with the splendid series of most important works produced during the same period by the entomologists of Europe. A mere enumeration of these would take a long time, but I think that this unprecedented activity in producing separate works has not been maintained in Europe in the latter half of the century, and is now largely superseded by society publications. Regarding the oldest North American books very little seems to be known; I fail to find in the whole literature any early notice of Melsheimer's Catalogue: it seems to have been little distributed here, as well as in Europe, and is now extremely rare. Say's American Entomology attracted considerable attention in Europe, and there are several notices thereof in European, but none so far as I can see in the contemporaneous American literature. We ought to suppose that the appearance of this work was hailed with joy by our few entomologists of those early days, but all I can find is a short passage in one of Dr. Harris' letters, in which he briefly announced to his friend, Prof. Hentz, the publication of the third volume of the American Entomology, in the same dry way as we would mention to each other the appearance of a number of the Canadian Entomologist or any other regular periodical. Mr. Ord, in his "Memoir of Thomas Say," written in 1834, calls this work "the most beautiful publication of this kind which has ever been issued from the American press," and informs us that the expenses were furnished by the enthusiastic publisher,

* Mr. T. R. Peale's contemplated "Lepidoptera Americana" has remained a fragment, and only a few pages and plates thereof were distributed in 1833, but apparently never placed on the regular market.

Mr. S. A. Mitchell. Dr. Morris, in 1844, calls it the most costly but not the most valuable work of Say.

The publication of North American entomological books proceeded at the very slow rate of one in every decade of years until a quite recent period, when they have become much more numerous as a sign of the great interest taken in entomological studies, but it is no exaggeration to say that a single person could easily carry all books on insects that have hitherto been published in this country in the way I speak about. However, after the year 1840, and more especially since 1852, the number of books on insects has been largely increased by the assistance from three sources, viz: the governments of several States, the general Government of the United States, and the Smithsonian Institution.

Some of the States have been very liberal in promoting and assisting economic entomology, but they have not done much in assisting the publication of separate works on entomology. In fact I can name only two such works: the first is Dr. Harris' classical "Report on the Insects of Massachusetts Injurious to Vegetation, published agreeably to an order of the Legislature, by the Commissioners on the Zoölogical Survey of the State." American entomology can justly be proud of this work, which, although possessing a distinct practical bearing, is, in the opinion of all, of still greater value as an introductory work in the study of American insects. Even now, after the lapse of nearly fifty years, this work, unchanged regarding the text, but rendered more attractive in its third edition by some plates and numerous figures, has not become antiquated, and is still by far the best work to be placed in the hands of the beginner. Harris himself seems to have felt that his work was of greater and more general value than indicated by the original title, and in that part of the first edition which was printed "at the charge of the author," he changed the title to "A Treatise on some of the Insects Injurious to Vegetation," etc.

Just the opposite must unfortunately be said of the second work printed at the expense of a State, viz: Mr. Emmons' Natural History of New York (1854), in which the insects occupy an entire quarto volume illustrated with fifty plates.

There are several instances on record where useless books have been printed at the public expense, but there has never been a more striking illustration of waste of money. The work is utterly worthless from whatever side it may be considered; it "remains a permanent example of misplaced confidence and liberality: an equal disgrace to the legislation, the science and the art of the great State in which it was published."

Like most other civilized governments, that of the United States has largely promoted and subsidized in various ways scientific research, and assisted in or undertaken the publication of scientific books. Up to the middle of the present century its efforts in this respect cannot be said to be very preeminent, but this has greatly changed since, and the number of splendid and valuable volumes issued by the government in all branches of natural history, as well as the liberality with which these volumes are made accessible to the public, constitute a peculiar American feature, and have never been equalled in any other country. Entomology has largely profited by these government publications, but most of the numerous papers published in the various surveys must be considered under the head of serials, and the Annual Reports of the U. S. Entomologists come unfortunately also in the same category. But we have Packard's Monograph of Geometridæ and Thomas' Acrididæ, which both may be considered as separate volumes; further the four reports hitherto issued by the U. S. Entomological Commission are to be included here, and also the special publications on insects issued by the U. S. Department of Agriculture. The Bulletins of the U. S. National Museum are comparable to the British Museum lists, and must be included under the head of separate volumes; the Bulletins of the U. S. Entomological Commission and those of the Entomological Division of the Department of Agriculture are difficult to classify bibliographically; they occupy an intermediate position between separate works and serials.

The Smithsonian Institution is something entirely unique. There is nothing comparable thereto in Europe or anywhere else, and its eminent services to natural sciences, and more especially to zoölogy, have always called forth the universal

admiration of the scientific world. To its liberal policy American entomology is deeply indebted, for we owe to it a splendid series of the most valuable and indispensable works on classification of North American Insects, which are too well known to be enumerated here. It suffices to say that while a few of these catalogues and synopses could possibly have been published by societies or through other channels, most of these Smithsonian works could not have been presented in any other way. The Monographs of North American Diptera, by Dr. H. Löw, for instance, would probably not have found a publisher in this country, and certainly not in Europe, because they were written by the greatest authority on Diptera. This would seem to be a strange and paradoxical objection, but I shall explain it presently.

Another and not inconsiderable series of separate volumes on North American entomology we owe to what are known as "authors' extras," which I consider amongst the greatest inventions, so to speak, of modern science. The study of entomology and that of any other science would, in fact, be completely blocked without "authors' extras," and rendered possible, and this under great difficulties and inconvenience, only to the few living in cities with very large libraries. I am too ignorant in bibliographical matters to know when and where this praiseworthy custom originated, but at any rate we are enabled thereby to add to the list of separate works, or at least to consider as such, all the Reports of the State and United States Entomologists: and what a blessing it is to handle and quote them as such, instead of as parts of awkwardly large and long-titled Transactions, most of us will know. It is certainly to be regretted that that splendid series of Reports which constitutes a unique feature in the American entomological literature and which embodies a branch of our science in which America has become a model for other countries, could not be published originally as separate volumes; for the Agricultural Transactions of which they form a part have not always attained a very high scientific standard, and are, most of them, by no means attractive samples of typographical art. The paper is miserable, the printing poor, and of the beauty

and scientific accuracy of the illustrations in the Missouri Reports no one can form a conception who knows them only in their original edition.*

I have now enumerated the sources through which separate works on North American entomology have been published. The works themselves do not present any distinguishing features: Harris' Treatise went through three editions, a fact which is not often repeated in entomological literature; and the number of editions of Dr. Packard's well known Guide, has, so far as I am aware, never been equalled by any other entomological work here or in Europe. I do not believe that, with the possible exception of Peale's work on Lepidoptera, there ever was a book written by an American entomologist which had to be left unpublished for want of a channel for publication. Some instances of this sort are known in the European literature, *e. g.*, a great and elaborate work by the great explorer of Russia, Pallas, on the Insect Fauna of Russia, has not been published for want of a publisher. The famous Dipterist, Dr. Hermann Löw, had the misfortune to be a most prolific writer on an order of insects which by no means belongs to the favorite ones.† For a long series of years he flooded and overstocked all German entomological as well as other scientific periodicals with his contributions to descriptive Dipterology, besides publishing as many separate volumes as he could find publishers for. His Monograph of the European *Asilidæ*, which nearly fills three entire volumes of the Linnæa Entomologica, caused the financial bankruptcy of the Stettin Entomological Society, for there was no sale for these volumes. His MS. of the fourth volume of the European Diptera, in continuation of Meigen's work; his second volume of the African Diptera; his great work on Diptera in Amber—all works representing years of assiduous and consci-

* By an accident one of the Reports of the State Entomologists, viz: the Second Illinois Report, has been published as a separate volume.

† Dr. C. A. Dohrn says that Löw was the owner of a steam factory of fly-paper; no one could deny the excellent quality of this fly-paper, but unfortunately there was never a market for it.

entious labor—have never been published, because no publisher could be found for them.

By far the largest portion of contributions to natural history, including entomology, has not been published in the form of separate books, but in the Transactions or Proceedings of societies, or in whatever form the periodical literature has assumed. This class of literature originated at a very early period, and flourished in America long before there were any entomologists here. The enormous and still increasing extent of periodical literature is one of the most characteristic features of modern science: in the Zoölogical Record for 1887 I counted the number of Journals and Transactions of learned societies which for that year contain zoölogical papers, and found the number to be not less than seven hundred and fifty; and if we deduct therefrom those which restrict themselves to limited branches, as the ichthyological, ornithological and similar journals, and which are, therefore, not likely to contain entomological papers, there remain about six hundred and fifty scientific periodicals appearing in one year, and which contain or may contain contributions to entomological science. Where would be our science without authors' extras? Of this number there are credited to North America eighty-five, but this does not include a single one of the Transactions and Proceedings of our numerous Agricultural and Horticultural Societies, which no doubt are legitimate channels for the publication of a certain class of entomological contributions. Moreover the editors of the Record, for 1887, have overlooked quite a number of American scientific periodicals, and if we add the number of those periodicals which have started since 1887, and those which have flourished at the beginning of this century, or later, and have now become extinct, the number of American serials is swelled to about one hundred and fifty. When, a hundred years ago, entomological science began to be cultivated here, the earlier authors found of course only a limited number of such periodicals at their disposal, but few as they were, they fully sufficed to accommodate all entomological articles. The trouble is that these early periodicals were issued in excessively small editions, and since there were no authors'

extras known at that time the writings of the earlier entomologists became practically inaccessible a few years after they were published. This had, of course, a great, depressing influence upon the development of entomological science in America. The writers, up to the middle of the present century, are full of complaint at the difficulty and impossibility of becoming acquainted with the literature, and this inaccessibility of the early literature is certainly characteristic of American entomology. The few persons that persevered in the study of entomology had to take recourse to a most desperate means to remedy this evil, viz: to copy the writings of Say, Harris, and even later authors when they had occasion to visit large libraries. The many manuscript volumes filled with such copies, and made by the younger Melsheimer and by Dr. Fitch, are mementoes of the difficulties under which the study of entomology labored at their time; and even now, I think, many of us, especially those who have dwelled in the West, have done, more or less, a little copying of older papers so as to be able to refer to them. An interesting illustration of this difficulty may be found in Dr. Morris' "Contributions to the History of Entomology in the United States (1844)," where, in order to be able to give a list of Say's writings, he was obliged to copy a list published in England by Doubleday in 1839. Of Harris' papers Morris was able to enumerate only eighteen numbers (up to 1844, when Harris was still living and working), while Scudder, in 1869, could enumerate fifty-one numbers up to 1844. Hagen's Bibliotheca, published in 1862, gives ninety-one numbers as the total of Harris' writings, while Scudder, seven years later, was able to give one hundred and five, one of these papers still being lost, and only known from the title. In our times some of these old authors are not more readily accessible, but their writings are no longer of such importance to us as they were to the entomologists of forty or fifty years ago. Moreover, we have now reprints of some of the most inaccessible papers, and more especially of those of Say. Very few persons who use the LeConte edition of Say are aware that they handle a unicum in entomological literature, for although single works or articles by various authors have been reproduced on many

occasions, there is no similar collection and reproduction of the writings of a single entomologist to be found anywhere in the literature.

So far as I am aware this difficulty has not been experienced by the European entomologist, at least not to that degree, and it is surprising to see from booksellers' catalogues how much of the old periodic literature of Europe is still to be had at very moderate price, whereas most of our older serials are now utterly out of print, or can only be obtained at exorbitant cost. To increase the difficulty of studying entomology, some of the older authors had the regrettable custom of publishing strictly scientific papers in utterly out-of-the-way places, which were inaccessible even to their contemporaries. What induccd Say to print, between the years 1830 to 1832, four important descriptive papers in the "New Harmony Disseminator," the most obscure village paper that could be found in this country, even in those early times, has not yet been explained; but to any one who understands how to read between the lines of Ord's biography of Say it becomes apparent that just about that time there was a great coolness between Say and his former friends in the East, and that Say, in his isolated position in the West, had probably no other place for publication. Among these papers is that on the North American Heteroptera, of which, according to Scudder, only one copy is known to exist in this country, viz: that which came into possession of the Boston Society of Natural History from Harris' library. It was finally republished by Fitch in 1857, and LeConte's second republication in 1859 is a reprint of Fitch. Dr. Harris did the same thing, and what makes the case against him worse is that he knew and acknowledged that he did something wrong. He printed, in the years 1828 and 1829, a series of purely technical descriptions, entitled "Contributions to Entomology," in what Dr. LeConte, many years afterwards, called a "vile sheet." This is the way in which Dr. Harris excuses himself (see letter of Harris to Hentz, dated November 19, 1828): "I am aware that the 'New England Farmer' is not likely to be much circulated among men of science, and therefore will not be considered the best authority, but it is a convenient

vehicle at present, and such is the ambition of European entomologists to anticipate Americans, that I willingly yield to the solicitations of several friends in publishing what may possibly contain many new species; and in doing so I am not actuated so much by personal considerations as a desire to aid several young entomologists in this vicinity, and by the wish to promote American science in general: *pro patria*. The 'Farmer' is taken at New Harmony, and will therefore come under the eye of Prof. Say. It is my intention, after these descriptions shall have undergone his rigid scrutiny, to republish them, either by themselves or in some respectable scientific journal." And the same Dr. Harris had, a short time previously, informed the same Prof. Hentz (see letter of Harris to Hentz, January 19, 1827), that the Journal of the Academy of Natural Sciences, of Philadelphia, was sadly in need of MS., adding: "If you could assist the publishers of the journal in this emergency by accounts of any of your undescribed objects of natural history, you will do them a thankful service, and they will furnish engravings for such drawings as you may send." Harris never kept his promise to republish these papers in a more accessible form, and they remained unknown until 1869, when they were reprinted by Scudder. Fitch also hid some of his purely technical papers so that they practically remained inaccessible; one of them, that on Winter Insects, has lately been reprinted by Lintner, while another, the "Catalogue of Homopterous Insects," ought to be republished. Walsh again sinned in this respect, but he was considerate enough to republish himself the papers in question in the Proceedings of the Boston Society of Natural History. This custom has, unfortunately, not ceased in our time, and in spite of the fact that entomological and other natural history journals go around begging for MS., as they did in olden times, an occasional technical paper is printed in what is but little better than a newspaper. I do not see that this custom has ever prevailed to any extent among the European entomologists, although much annoyance and inconvenience in the literature has been caused there by the practice of certain authors of issuing papers on separately printed sheets, without

date, and containing one, or, at most, a few pages. Every one knows what mischief and confusion in the nomenclature and classification of Lepidoptera have been brought about by Jacob Hübner's Tentamen and Verzeichniss, of which, up to our days, and in spite of much discussion and investigation, nobody knows when they were published, or whether they should be considered as publications, or whether the author himself ever considered the former as such. In Switzerland the custom prevailed for a series of years among the scientists of presenting new year or birthday congratulations in the form of a privately-printed tract, and since these were issued only in a single, or, at most, a few copies, no one knows whether or not to consider them as publications. Also in the form of university programs and dissertations, and in the programs of gymnasiums and high schools, which never came into circulation, many entomological papers by the older authors have been completely buried out of sight.

The most satisfactory and most accessible form of publication of smaller articles is undoubtedly in journals exclusively devoted to a particular branch of science. Such serials were either issued by societies or single individuals or publishing firms. This last-mentioned form antedates in entomological science by far the society publications, and the honor of having produced the first entomological journal of this kind belongs to Switzerland, where, as early as 1778, an enthusiastic entomologist and bookseller, Mr. J. C. Füessly, started the "Magazine for Amateurs of Entomology," of which several volumes were issued, and this was quickly followed by others, *e. g.*, Illiger's Magazine, Germar's Magazine, etc.. To-day quite a number of such journals flourish in England, Germany, France and Austria. I count as the total of such European journals no less than twenty-eight, of which sixteen are extinct and twelve still living. In North America this class of literature did not make its appearance until quite recently, and the efforts made to introduce it have hitherto been very short-lived, not on account of the poor quality of these journals, but from lack of support on the part of the entomologists. In fact, one of the most striking characteristics of the North American entomologists is that

they do not subscribe to the entomological journals of their own country. Thus the *American Entomologist*, edited by Walsh and Riley, lived only for two volumes (1868–1870), but revived afterwards (1880) for a third volume; the second periodical of this kind, the *North American Entomologist*, edited by Grote, was starved to death in the first year of its existence (1881). The *Practical Entomologist*, edited by Walsh, was published by the Entomological Society of Philadelphia, and occupies, therefore, an intermediate position between the serials I am speaking about and the Society publications. At any rate, it has been the first periodical exclusively devoted to economic entomology, and is in every respect the predecessor of the *American Entomologist*. As a continuation of this last may be considered "*Insect Life*," edited by Prof. Riley, and which, since it is published by a government institution, constitutes a unique feature in the entomological literature. These three monthlies, the *Practical Entomologist*, the *American Entomologist*, and *Insect Life*, devoted almost exclusively to the biography and economy of insects, form a unique series to which there is nothing comparable in the European literature; and all I can name of similar works, is a French monthly, the "Bulletin d'Insectologie agricole," and perhaps also the Hungarian "Rovartani Lapok."

Entomological societies were formed at a very early time, and London, in England, can boast of having harbored the first seven societies of this kind. The oldest of them, the *Societas Aureliana*, is said to have flourished as early as 1745, but nothing is known of it except that in 1748 a fire destroyed its library and collection, and that this conflagration was also the end of the Society. Of the three following societies we also know nothing except their names, but the Societas Entomologica, in London, founded in 1806, was the first to issue a periodical under the title "Transactions of the Entomological Society of London," edited by Haworth, one volume thereof being completed between 1807 and 1812. But in 1813 the Society disbanded, for reasons unknown to me. After a long interval the Entomological Club of London started, in 1831, "The Entomological Magazine." After that date entomolog-

ical societies were rapidly formed in almost every country in Europe, and there are now no less than seventeen societies, distributed as follows: Germany, six; England, four; Switzerland, two; Belgium, Holland, Sweden, Russia and Italy, one each. I count only those which have published anything, but there are no doubt many more in existence. One of the German societies represents the very rare phenomenon of a bifurcation, having split in two different societies. In 1856 an Entomological Society was founded in Australia, and is publishing the Transactions of the Entomological Society of New South Wales.

In North America entomological society life did not begin to develop until 1842, when the Entomological Society of Pennsylvania was founded. It never published anything; it never had any regular meetings nor a constitution: nevertheless it accomplished a great deal of good by planning the preparation of several papers by its members, and more especially by attracting the attention of European entomologists. We owe to this society the first and still the only reference Catalogue of North American Coleoptera, which was published by the Smithsonian after many years of delay. Society life in earnest began in 1860, when the Entomological Society of Philadelphia was founded, which, in 1861, began to publish its *Proceedings* (six volumes), and since 1868, having changed its name to the American Entomological Society, its *Transactions*. It has also published the *Practical Entomologist* (two volumes), the *Synopsis of North American Hymenoptera*, and a *Check List of North American Coleoptera*. Other societies were rapidly organized afterwards: the Entomological Society of Ontario, which has published, since 1868, an Annual Report and the *Canadian Entomologist*; the Cambridge Entomological Club, founded in 1874, which is publishing *Psyche*, and has also issued bibliographies of some of our prominent entomologists; the Brooklyn Entomological Society, organized in 1872, published, between 1878 and 1884, seven volumes of its *Bulletin*, and, since 1885, after its union with the New York Entomological Society, the *Entomologica Americana*; it also published two Check Lists of North American Insects (one of the

Lepidoptera, the other of the Heteroptera); the New York Entomological Society, which published, between 1881 and 1884, four volumes of *Papilio*, but finally merged into the Brooklyn Society. It is, however, unique from being the first to publish a journal devoted exclusively to a single order of insects, a somewhat premature venture, but which will no doubt be followed by other societies in a future not so very far remote. Finally the Entomological Society of Washington, organized in 1884, is vigorously publishing, since several years, the first volume of its *Proceedings*. Besides the above-mentioned publishing societies, there is flourishing the Entomological Club of the American Association for the Advancement of Science, which is admirably adapted for promoting personal intercourse among our entomologists and mutual exchange of experience; there is, further, an Entomological Society in Newark, N. J.; and lastly, there is the Association of Official Entomologists, which is still in the embryo stage. If we leave out of consideration all those societies which have not contributed to literaturé, we find that we have, or have had, in North America, six entomological societies with publications, in comparison with nineteen in Europe. This gives us an excellent showing, considering that North America has about seventy millions of inhabitants to more than four times that number in Europe, not to speak of the cheaper printing, the much greater number of subscribers, and other advantages enjoyed by the European entomologists. As to variety of subjects treated and the quality of articles, our entomological serials are certainly not inferior to the European serials; and so much can be said in praise of our periodicals that, as a rule, they have been kept free from those quarrels of a personal nature which fill page after page in certain European journals; nor have they ever assumed that excessively local character which prevails in some other European serials.

I have hitherto not spoken of the entomological publications of the Agricultural Experiment Stations, because they form such a striking and exceptional feature in American entomology. I consider the reorganization of these stations, as effected in 1888, by what is known as the Hatch bill, as one

of the most important events in the history of American entomology. With the perfection of this organization we will ultimately not only have as many official entomologists as we have States, but with them just as many centers for instruction and diffusion of entomological knowledge, so that the beneficial influence of these stations on the future study of entomology cannot be estimated high enough. And even if, for the present, an exclusively popular and practical treatment of entomological subjects is required from these stations, a great deal of purely scientific matter naturally must be, and, in fact, has already been accumulated in the Bulletins of the stations.

We all remember that at the very start one or two of these bulletins were not of a promising nature, but we have now a large number which are excellent in their popular and practical bearings, and at the same time valuable contributions to purely scientific entomology. And this high standard will be maintained and still increased in future by the combined force of ambition and competition.

Considered as publications these bulletins are difficult to classify; they are neither separate books nor can most of them properly be placed in the periodicals. But this is a matter of very subordinate importance, and since these publications are of very recent date their proper status will sooner or later be regulated. Intrinsically, they are no doubt fully comparable with, and fully equal to, the Reports of the State Entomologists, and I was amazed, therefore, at a resolution recently passed at a representative assembly of the official entomologists to the purport that descriptions of new species should be excluded from the bulletins, whereas there has never been any doubt expressed regarding the propriety of such descriptions whenever they became necessary in the reports of the State officers. It seems to me that the entomologists have overlooked the fact that, scientifically, there is not the slightest difference in the value of a description of a new species and the description of an hitherto unknown or but imperfectly known life history of some insect. The one is a novelty for systematic, the other a novelty for biographic entomology. Such bio-

graphic matter cannot possibly be excluded from the bulletins, and I think a reconsideration of this resolution should take place at the next opportunity.

In conclusion I would beg leave to devote a few words to a certain class of entomological articles, which is also characteristic of our country, viz: that which appears in the columns of our daily or weekly press and in allied journals. That there is no better means for widely disseminating information than through the press there can be no question, and a well-written article on some insect, occupying say one-half or one whole column of a newspaper, is infinitely more read and does infinitely more good than an elaborate treatise on the same insect occupying hundred or more pages and published in the bulky volumes of official reports. In fact, so evident is here the importance and usefulness of the press that the official entomologists should make it their duty to use its columns as often as possible, and I am glad to see that most of our entomologists consider the subject in this light. But it assumes a different aspect from the fact that these newspaper articles are included in the bibliographies of economic entomology, which nowadays have become a conspicuous element in our literature, and without which almost any article is considered incomplete. With this practice economic entomology places itself in direct contrast and conflict with the rules now universally adopted by zoölogical bibliography. While it is, of course, not possible to discriminate sharply between what is to be considered a scientific journal and a newspaper, and while it must largely be left to common sense to draw this dividing line, science cannot possibly recognize as fit places for scientific publications such papers as the "The Evening Star," "Daily News," etc. Scientific zoölogy, including entomology, cannot possibly recede from its position without opening the door to all sorts of annoyances and abuses; and if the economic entomologists persist in this practice, practical entomology will be in danger of drawing apart from scientific entomology, and so a breach be opened between the two branches of the science which would rapidly widen until it be no longer possible to bridge it. This would be a calamity, and would tend to lower economic

entomology from the high standard of a science to the level of journalism. It is to be hoped, therefore, that considerations for the general welfare and standing of economic entomology as a science will prevail and that a way will be found to avert the impending danger.

FEBRUARY 6TH, 1890.

Eight persons present. President Marx in the chair.

Mr. Schwarz read the following paper:

A LIST OF THE BLIND OR NEARLY EYELESS COLEOPTERA HITHERTO FOUND IN NORTH AMERICA.

BY E. A. SCHWARZ.

In his exhaustive treatise on the Cave Fauna of North America (Memoirs Nat. Ac. Sc., Vol. iv, No. 1), Dr. A. S. Packard has given a list of the blind or nearly eyeless insects from North America and other countries, but since this work is not in the hands of many entomologists, I have thought it worth while to present herewith another list, confining myself, however, to the Coleoptera.

I. CAVERNICOLOUS SPECIES.

a—Caves of the Green River Basin, in southern Kentucky.

Anophthalmus Tellkampfi Er. Quite common in most caves.

Anophthalmus interstitialis Hubb. Mammoth cave and Cave City cave.

Anophthalmus audax Horn. Hitherto found only in Ronald's cave (Hubbard).

Anophthalmus Menetriesi Mots. Found abundantly in most caves.

Anophthalmus pubescens Horn. Cave City cave; Walnut Hill Spring cave; Lyon cave; Saltpeter cave; Ronald's cave; Downer's cave.

Adelops hirtus Tellk. Common in most caves. Eyes feebly developed.

b—Caves of southern Indiana.

Anophthalmus tenuis Horn. Wyandotte cave; Bradford cave.

Anophthalmus eremita Horn. Wyandotte cave.

c—Caves of the Alleghany Mountain District.

Anophthalmus pusio Horn. Erhart's cave, Montgomery Co., Va.; Luray cave, Luray Co., Va.; X cave, Carter Co., northeastern Kentucky.

d—Alabaster cave, El Dorado Co., Cal.

Anillus explanatus Horn. This species will no doubt be found also under large stones or deep layers of old leaves outside of the cave.

II. NON-CAVERNICOLOUS SPECIES.

Anillus debilis Lec. Found under stones at San Jose, Cal. (LeConte); under old leaves at San Antonio, Texas (Schwarz). The only specimen from the latter locality is in the LeConte collection at Cambridge.

Anillus fortis Horn. Mountains of eastern Tennessee; Mountain Lake, Montgomery Co., Va. (Ulke); Pennington Gap, Cumberland Mountains, Va., under old leaves (Hubbard); Washington, D. C., under deeply interred stones (Ulke).

Anillus Dohrni Ehlers. Described from Florida without more precise indication of locality. It has, to my knowledge, never been taken by any American entomologist, and I cannot suppress some doubt regarding the correctness of the locality.

Platypsyllus castoris Ritz. The well-known parasite of the beaver. Specimens are known from Alaska, Canada, Nebraska, southwestern Texas and southern France.

Leptinus testaceus Müll. Parasitic on wood-mice and other small rodents; known from Iowa, Pennsylvania, District of Columbia and northern and central Europe.

Leptinillus validus Horn. Parasitic on the beaver. Originally described from the Hudson Bay region, it has subsequently been found on beaver skins from Alaska. The species has feebly developed eye-spots.

Pinodytes cryptophagoides Mannh. Originally described from Sitka, Alaska (found under a stone), it has subsequently been found in large numbers in northern and southern California, in the mountains of Virginia (Mountain Lake, Ulke) and Maryland (Deer Park, Schwarz), and at Washington, D. C. (Ulke, Schwarz). The specimens found by myself occurred under deep layers of decayed leaves.

Pinodytes n. sp. A large and as yet undescribed species found by Dr. Hamilton, near Pittsburg, Pa.

Scydmænidæ. An undescribed species of this family, and forming a new genus, has been found by Mr. Ulke at Mountain Lake, Montgomery Co., Va., in the ground under decaying leaves. The eyes are rudimentary.

Cephennium anophthalmicum Brend. Found under vegetable debris in Alameda Co., Cal.

Adranes cœcus Lec. Virginia, Pennsylvania and Western States. Strictly myrmecophilous. The specimens found by myself occurred in a colony of *Lasius alienus* under the loose bark of an old pine tree.

Adranes Lecontei Brend. Michigan, Illinois, Iowa. Strictly myrmecophilous. Specimens were found by Mr. Hubbard in a rotten log among *Lasius umbratus*.*

Eutyphlus similis Lec. (*Nicotheus tibialis* Casey). Mountains of Virginia (Mountain Lake, Ulke; Pennington Gap, Hubbard) and Maryland (Deer Park, Schwarz); Washington, D. C. Occurs under deep layers of old leaves. The eyes are more or less rudimentary, sometimes almost entirely absent.

Ptinella pini Lec.

Ptinella quercus Lec. These two closely allied species live under moist bark of old stumps, and are widely distributed in the Atlantic and Western States, occurring from Canada and Michigan to Alabama and Florida. There are blind and wingless specimens among them, as well as winged ones provided with distinct eyes. These latter specimens are, according to Mr. Matthews, the females, and the blind specimens the males. Mr. Reitter asserts the contrary, while Mr. K. Flach (Wien. Ent. Zeit., viii, 1889, p. 218) concludes that both forms occur in both sexes, but so that a stationary, blind and wingless generation alternates with a migrating generation which is winged and provided with eyes. *P. quercus* usually occurs in large colonies, of which, in my experience, the majority of the specimens are blind and wingless, while in each colony always a few specimens with eyes and wings can be found. This would seem to speak against Mr. Flach's theory.

Ptinellodes Lecontei Matth. Under bark of deciduous and coniferous trees, as well as under old leaves in Georgia and Florida. It does not seem to live in large colonies, but, as the preceding species, occurs in two forms, one provided with distinct eyes, and the other entirely blind.

Limulodes paradoxus Matth. Of this only blind specimens are known. A strictly myrmecophilous species (among *Lasius aphidicola* and no doubt other species of *Lasius*), and widely distributed in the Atlantic and Western States.

Colydiidœ. A remarkable undescribed species with rudimentary eyes, and constituting, no doubt, a new genus,† has been found in middle California. I know nothing of its habits.

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* A remarkable blind genus of *Pselaphidœ*, allied to *Batrisus*, has recently been described by Dr. Brendel as *Anops amblyoponica*. It occurs in Pennsylvania in the nests of a blind ant, *Amblyopone pallipes*.

† Since described by Capt. Casey as *Megalaphrus tenuicornis*.

Aglenus brunneus Gyllh. No doubt artificially introduced from Europe with potted plants. Specimens have been found at St. Louis, Mo., and San Francisco, Cal. (Casey). It lives under vegetable debris.

Alaudes singularis Horn. No doubt strictly myrmecophilous; specimens are known from California (Horn) and Oregon (Wickham).

Compared with the large number of blind or nearly eyeless Coleoptera known from Europe, the North American fauna appears to be an extremely poor one. The absence of blind *Staphylinidæ* and *Curculionidæ* * is more especially noticeable. Regarding the cavernicolous species, it may be said that a sufficently large number of our caves have been explored by competent investigators to show that we cannot reasonably expect any important additions to our fauna. A few new species of *Anophthalmus* will probably still be discovered, but hardly any new or striking genera such as *Leptoderus*, *Pholeuon*, etc., of the European fauna. As to the non-cavernicolous species, however, the scarcity of species in our fauna is no doubt largely due to the lack of proper and careful investigation. Many of the most interesting blind species have been found in Europe under large and deeply interred rocks—a mode of collecting which, to my knowledge, has never been attempted in North America—and I venture to predict that the southern parts of the Alleghany Mountains, southern California and other portions of the Southwest will, in future, yield many interesting additions to our list of blind Coleoptera.

Mr. Schwarz had introduced some general remarks on the blind insects of other orders, in the discussion of which Mr. Howard stated that two of the three genera of eyeless Chalcididæ belong to the Fig insects, and that in ants, in many genera, one or other form is blind, and in Eciton the workers are blind.

In this connection, Mr. Schwarz called attention to the fact that the soldiers in termites are always blind. He also stated that there are but two blind Diptera known, aside from the many blind fleas. In Hemiptera blind forms are limited to full-grown female Coccids and to the male of *Lecanium hesperidum*.

* By an unfortunate clerical slip in a synoptic table, Prof. Lacordaire (*Gen. d. Col.*, vii, p. 328) places the genus *Lymantes* among those without eyes, but from Lacordaire's own description, as well as from those given by Schönherr and Gyllenhal, it is evident that the genus is provided with eyes.

Mr. Howard held that the eye-spots of some of the Coccids ought to be called true eyes, and in this was supported by Prof. Riley, who stated that the young all have eyes.

Prof. Riley further stated that vision must be very feeble in insects such as larvæ having eye-spots only, and also called attention to the somewhat remarkable fact of adult insects with highly complex eyes coming from eyeless larvæ, as is especially the case in Diptera.

Prof. Riley presented the following:

NOTES ON THE LARVA OF PLATYPSYLLUS.

By C. V. Riley.

The discrepancy in size between the larva of *Platypsyllus*, as hitherto described, and the mature insect, has led me to suspect that the last larval stage as well as the pupa remained to be discovered.

A specimen recently obtained and described and figured by me (*Entomologica Americana* for February, 1890, pp. 27–30), as the "Ultimate Larva," is in general appearance strikingly Mallophagous, and a few points may be mentioned as not sufficiently emphasized in the published description. The arrangement of setous hairs on the venter recall that in the adult, while the raised dorsal points, though unarmed, foreshadow somewhat the setous points on the dorsal abdominal joints of the adult. Remnants of the anal cerci of the earlier larval stages are noticeable in the two slight swellings on penultimate joint, each surrounded by a series of short spinous hairs. The spiracles are small and lateral, but may be detected with difficulty at the inner angle in the notch between the abdominal joints. The prothoracic spiracle has not been detected.

I have, in the paper alluded to, raised a parenthetical question as to this being the final form of the *Platypsyllus* larva, but the position and character of the mouth parts, and particularly the single-jointed tarsi exclude it from the Mallophaga, while its general characteristics, though departing in so many respects from the earlier larva, have caused me to refer it to *Platypsyllus*—a reference which its occurrence on a beaver, in connection with other stages of *Platypsyllus* and with no other similar insect, strengthens. The principal feature that would shake one's faith in this reference is the presence of ocelli, since none occur in the earlier larva nor in the imago, and

while such a feature is abnormal under the circumstances, it is no more so than many of the other features of Platypsyllus.

In the discussion of this subject, Mr. Schwarz held that, if not the ultimate larva of *Platypsyllus*, it is certainly Coleopterous, and cannot be referred to the Mallophaga. In the Coleoptera, the Staphylinid genus *Amblyopinus* is known to be parasitic on terrestrial rodents, two species having been found in the fur of mice and rats, one in South America and the other in Tasmania. We might reasonably expect to find this genus in North America under similar circumstances, but a glance at Prof. Riley's larva shows that it cannot possibly belong to the *Amblyopinus* nor to any other genus of Staphylinidæ.

Dr. Marx read the following paper:

A CONTRIBUTION TO THE KNOWLEDGE OF NORTH AMERICAN SPIDERS.

By Dr. Geo. Marx.

In a large collection of natural history objects from all parts of this country the student will find some specimens, which, by their peculiar and strange morphological features, he cannot place in any of the established families. They lie, consequently, buried in the collection, and are thus lost to science.

I possess in my collection of North American Arachnida a number of such new forms, which I have hitherto been unable to place in any established family. The principal cause of this difficulty is that the American Arachnologist has still to follow the classification of the European Arachnida, and that no attempt has so far been made to work out, independently, a systematic arrangement, based upon the spider fauna of America. Mr. E. Simon has lately published a list of families of extra-European Araneæ in a systematic order,* and he has promised

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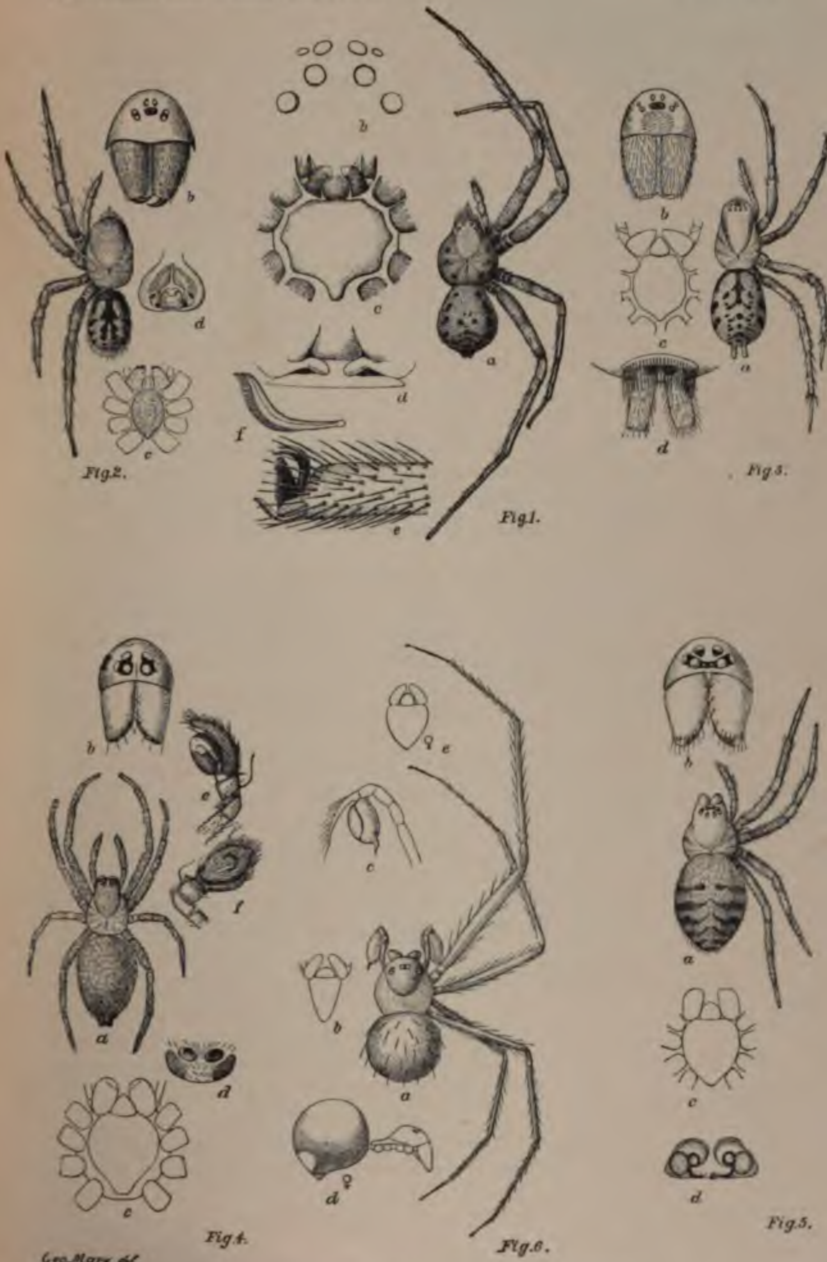
*Simon, in his "Remarques sur la Classification des Araignées" (Études Arachnologiques, 22e mémoire, Annales Soc. Ent., France, 1890, p. 79), presents a "succinct tableau" of the families of *Araneæ*, including those which he had to establish for extra-European Spiders. He withdraws two of his former suborders, the *Gnaphosæ* and *Oculatæ* (Les Arachnides de France, Vol. I, p. 14), leaving only the *Theraphosæ* and the *Araneæ veræ*. These latter denominations Simon prefers in place of *Tetrapneumones* and *Dipneumones*, as these names indicate some characters which are subjected to some exceptions, e. g., *Hypochilidæ*, which he places amongst the *Araneæ veræ*. The author divides the hitherto described spiders into thirty-nine families, of which eighteen are established upon exotic genera.



NEW SPIDERS FROM NORTH AMERICA.

to present in the near future a complete classification of the exotic Araneæ, which, no doubt, will be of the greatest usefulness for the study of the North American fauna.

In order that some of the new forms in our fauna, which have accumulated in my collection, can be referred to by the student of general classification of spiders, I present herewith the descriptions and illustrations of three new genera, whose affinity and relationship have remained obscure to me, and also avail myself of this opportunity to add descriptions of some other new genera, which I have had no difficulty in placing systematically, but which I deemed interesting enough to be put on record.

Homalonychus, nov. genus.

Cephalothorax nearly as broad as long, flat; pars cephal. not higher than thorax, narrow and pointed anteriorly; clypeus less than one-half as broad as the width of pars thorac., high and perpendicular; pars thorac. nearly circular, with a long and distinct median fissure.

Eyes eight in two rows. Anterior row straight, short, M. E. nearly twice as large as the L. E. of this row, as large as those of the posterior row, and about their diameter apart from each other, while the L. E. are closer to them. Space between anterior row and margin of clypeus about five times as large as the diameter of the A. M. E. Posterior row very much recurved, eyes of equal size, space between P. M. E. larger than that between them and the P. L. E.

Mandibles cylindrical, attenuated at tip, of medium size and slightly pointed backward, more slender than femur I, parallel and contiguous throughout; claw small and weak.

Maxillæ longer than broad, strongly inclined over labium, outer side straight, inner side emarginate to fit around the tip, in front squarely truncate, nearly meeting in front of labium.

Labium two-thirds the length of the maxillæ, longer than broad, subovate, rounded at tip.

Sternum arched, circular, with impressions opposite the coxæ, and drawn out between coxæ IV.

Palpal claw toothless, long and curved.

Legs stout, rather long; the fourth pair the longest, the first nearly as long: 4. 1. 2. 3; femora somewhat inflated at base. Tarsi with two long, slender, smooth *claws without teeth*; hypopodium of dense, fine, short, not clavate hairs. Metatarsi and tarsi of all legs with scopula, the terminal spines of the scopula long and projecting over the hypopodium.

Abdomen rhomboid, truncate at base, flat at dorsum, terminating in the spinnerets.

***Homalonychus selenopoides*, nov. species.** Plate I, fig. 1.

Cephalothorax long, 4 mm.; broad in front of clypeus, 1.3 mm.; broad at middle, 3.6 mm. Abdomen long, 4 mm.; broad at base, 2 mm.; broad at the widest part, 3.5 mm.; total length, 8 mm.

Leg i	Femur 4.5	Patella 1.6	Tibia 4.4	Metatarsus 3.2	Tarsus 2.2	Total 15.9 mm.
" ii	" 4.2	" 1.6	" 4	" 3	" 2	" 14.8 mm.
" iii	" 3.5	" 1.2	" 3	" 2.4	" 1.8	" 11.9 mm.
" iv	" 5.0	" 1.7	" 4.6	" 4	" 2.3	" 17.6 mm.

Cephalothorax brown, with three black small spots on each side near the lateral border; pars cephal. a little lighter in color, trophi and sternum yellowish brown. Mandibles covered with dense dark-brown and short hairs. Abdomen light grayish olive-brown, with a row of six black spots on each side and three black, transverse, short lines on the posterior area. The whole abdomen and the legs densely covered with very short stiff bristles. Legs more yellowish, with indistinct indications of darker rings at base, tip and middle region of the femora and a few similar rings on the other joints; all joints, especially the tibiæ, metatarsi and tarsi, provided at the under side with long spines standing upon black basal points; the short stiff bristles on all metatarsi and tarsi, and on the tibiæ of two anterior pairs arranged in distinctly separated longitudinal lines. These are at the under side denser and longer, forming thus a scopula. A hypopodium, or cushion of soft, dense hair between and below the tarsal claws, triangular and very prominent. There is also a peculiarly formed auxiliary claw below the hypopodium and projecting over it; it is bent upward, and its under side is provided with a dense row of teeth or stout hairs. See figure 1 *f*.

This spider shows affinities with the family *Sparassidæ* by the arrangement of the eyes (*Parhedrus*, Simon) and by the flat body and toothless claws (*Selenops*). But in other structural features it deviates from the characters of this family, *e. g.*, in the relative length of the legs, and in the fact that here the maxillæ are strongly inclined over the labium.

Habronestes L. Koch.*

Cephalothorax long, high, with nearly parallel sides; pars cephal. two-thirds of the length of cephalothorax, anteriorly broad, nearly as broad as thorax; clypeus high and rounded, median fissure very small.

*Since the presentation of this paper to the Society I have discovered that this spider, to which I had given a new generic name, belongs without doubt to the genus *Habronestes* L. K., family *Enyoidæ*. This genus is very closely allied to *Storena* Walck, and has hitherto only been collected in Australia (thirteen species). My specimen, which constitutes a new species, was collected in 1882, at Cohuta Springs, Murray Co., Ga., by my late friend, L. D. Ferguson, of Philadelphia; he found it in

Eyes 8 in two rows, which are so strongly procurved that they appear to form three rows. The first row consists of two eyes, which are twice their diameter distant from each other and about three times their diameter from the margin of the clypeus. The second row, consisting of four eyes, is straight and a little broader than the first; the two contiguous M. E., which are slightly larger than all other eyes, stand in front of the free space between the two eyes of the front row; the lateral eyes stand about the length of their diameter from the M. E. and close to the eyes of the first row. The two eyes forming the third row stand closer together than their diameter and a little farther from the M. E. of the second row, with which they form a quadrangle a little longer than broad.

Mandibles cylindrical, as stout as femur I, of moderate length, vertical and parallel. Claw small and weak.

Maxillæ longer than broad, slightly broader at base, inclined over labium; truncate at tip; outer side straight, inner side emarginate.

Labium two-thirds the length of maxillæ, longer than broad, with rounded sides.

Sternum long, narrow, oval and arched, without impressions.

Legs 4. 1. 2. 3, short and stout. Three tarsal claws, the superior with 6–8 teeth, inferior prominent.

Abdomen short, oval. Inferior spinnerets the longest, two-jointed, contiguous; superior pair shorter and farther apart.

Habronestes americanus, nov. species. Plate I, fig. 2.

♀ Length of cephalothrorax 4.2 mm., width at clypeus 2.2 mm., width in the middle 2.5 mm. Length of abdomen 3.8 mm.; total length 8 mm.

Leg i	Femur 2.5	Patella 1.4	Tibia 2.2	Metatarsus 1.7	Tarsus 1	Total 8.8
" ii	" 2	" 1	" 1.6	" 1.6	" 1	" 7.2
" iii	" 2	" 0.8	" 1.2	" 2	" 1	" 7
" iv	" 2.8	" 1.3	" 1.8	" 2.5	" 1.5	" 9.9

Cephalothorax reddish testaceous, glossy; mandibles dark brown, densely covered with short bristle-like hairs; maxillæ pale yellow, lighter at tips; labium and sternum reddish; legs reddish yellow; abdomen sparsely covered with soft black hairs, greenish yellow, with a broad black spot occupying the base and dividing posteriorly into three branches, the middle one extending back about two-thirds of the length of abdo-

a dark corner of an old abandoned stable. It is certainly a remarkable and noteworthy fact that an Australian genus is represented in the Apalachian mountains of the Southern States in the same region where *Hypochilus Thorellii* occurs, while the other known species of *Hypochilus* (*H. Davidii* Simon) lives in China. I have not suppressed my description of the genus, as the original description of Koch is not readily accessible, having been published in the "Arachniden Australiens," Vol. I, p. 299.

men. having three equally distanced serrations at the outside border; at the second tooth-like lateral projection the band divides longitudinally and is continued to the apex as three pairs of small round spots. The two lateral branches run close to the sides only a short distance backward and are then broken up each in a row of three larger spots. The under side of the abdomen is pale gray, with two small black spots at the base of the inferior spinnerets.

Legs sparsely covered with a long and soft pubescence, which is particularly long at the underside of metatarsi and tarsi but not dense enough to form a scopula; the two anterior pairs of legs without spines, excepting a spinous bristle on femur I at the inner side near apex; femur III and IV with a few scattered bristles. Patella, tibia and metatarsus of these legs covered with short spines all around. Tarsi III and IV without spines. Tarsal claws with from six to eight small teeth. Eyes grouped close together, occupying less than the whole middle third of anterior cephalic region. Coxæ IV as long as the width of sternum, coxæ I longer.

Lutica,* nov. genus.

Cephalothorax long, rather narrow, anteriorly two-thirds of the width of thorax; cephalic part high, very distinct and rounded. Clypeus truncate, median fissure very short.

Eyes 8 in two rows, anterior row a little shorter than the posterior; both rows slightly procurved when seen from above; when viewed from the front the posterior row is very much procurved. The A. M. E. the largest, subcontiguous; distance between them and the A. L. E. equals the diameter of the latter. Eyes of posterior row subequal, the median closer together than they are from the lateral.

Mandibles perpendicular, moderately long, as thick as femur I. Claw small.

Maxillæ triangular, longer than their basal width, strongly inclining over the labium.

Labium subtriangular, higher than its basal width, rounded at tip.

Sternum broadly oval, nearly as broad as long.

Palpi of female with a four-toothed claw and a horny groove at the tip of the tarsal joint, beneath the claw.

Abdomen small, oblong oval, smooth and narrow. Only *two* long and cylindrical spinnerets (the superior), the others aborted and only indicated by tufts of long hairs.

Legs 4. 3. 1. 2, short, slender, with three tarsal claws. Anterior leg not thicker than the others.

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* Indian name for spider.

Lutica maculata, nov. species. Plate I, fig. 3.

Female. Length of cephalothorax 2.5 mm. Width at clypeus 1 mm. Width of thoracic part 1.4. Length of abdomen 2.8 mm. Total length 5.3 mm.

Leg i	Femur 1.5	Patella and Tibia 1.6	Metatarsus 0.8	Tarsus 0.8	Total 4.7 mm.
" ii	" 1.4	" " 1.1	" 0.4	" 0.5	" 3.4 mm.
" iii	" 1.6	" " 1.4	" 1	" 1	" 5 mm.
" iv	" 1.8	" " 1.8	" 1.4	" 1.2	" 6.2 mm.

Cephalothorax, trophi, palpi, sternum and legs pale yellow testaceous; cephalic part marked at the sides by a brownish band, leaving the median area light. Abdomen mottled with white and gray; a black band surrounds the base in front and at the side to about the end of the first third of its length, and is then broken up on each side into two short oblique stripes. Three rows of small black dots run over the dorsum back to the apex; the first dot of the middle band is connected with the transverse basal band by a small stripe. Anterior two pair of legs not spined, femora III and IV only at their tip, and all other joints of them covered with short spines, at the terminal extremity of the metatarsi a circle of long spines. Superior tarsal claws long, slender, curved, with eight and ten long teeth; inferior claw extremely minute.

One female from Lake Klamath, Oregon.

The principal feature of interest in this spider is that it possesses only two spinnerets (the superior); the other four are aborted, and only indicated by tufts of hair. There are at present only three genera known which possess only one pair of spinnerets: *Palpimanus*, *Stenochilus* and *Cryptothele*. These genera are in all other respects so widely differing from each other that for each a separate family had to be established. To none of these genera *Lutica* shows any special affinity, only the peculiar form of its maxillæ resembles those of *Cryptothele*.

Another noteworthy character of rare occurrence in *Araneæ* is that the third leg is longer than the first, and the second leg the shortest.

Neophanes, nov. genus.

Cephalothorax a little longer than broad, anteriorly about half as broad as in the middle region, truncate in front, rounded posteriorly, p. cephal. high, prominent, two-thirds of the whole length of the cephalothorax; dorsum highly arched; median fissure distinct.

Eyes 6, in two groups of three each, separated longitudinally by a space whose width is about equal to twice the diameter of a single eye; the three eyes of each cluster form a triangle, the inner side of which is the longest. Eyes equal and round, anterior pair close to the margin of the clypeus.

Mandibles strong, cylindrical, inflated in the middle region, slightly diverging, without teeth at the claw-groove. Claw long and curved.

Maxillæ slightly longer than broad, inclined over the labium, a little broader at the truncated tip.

Labium about two-thirds the length of the maxillæ, subtriangular, as long as the basal width, rounded at tip.

Sternum round-ovate, a little longer than broad, pointed between the coxæ IV.

Legs short, fourth pair the longest, without spines, moderately stout. Three tarsal claws, superior with from 8 to 10 long and very slender teeth. Calamistrum distinct.

Abdomen ovate, pointed at tip. Cribellum oval, undivided.

Neophanes pallidus, nov. species. Plate I, fig. 4.

Female. Cephalothorax long, 0.6 mm.; abdomen long, 1 mm.; total length, 1.6 mm. Leg I, 1.3 mm.; II, 1.2 mm.; III, 1 mm.; IV, 1.5 mm.

Cephalothorax and trophi pale orange yellow; abdomen and legs yellowish white. Body and legs sparsely covered with grayish hairs; no spines. Cephalothorax one-fourth longer than broad, dorsum high and arched, the highest point at the middle region, from where it evenly slopes to both margins; p. cephal. two-thirds the whole length. Anterior eyes about their diameter away from the margin of clypeus. The six eyes surrounded by black pigment, which fills out the interspaces between them; the four middle eyes form a quadrangle, which is higher than broad and slightly broader in front. The front eyes are nearer to the lateral than the latter to the posterior eyes.

The *male* is smaller than the female, but resembles it in all other respects. The patellar and tibial joints of the palpi are together shorter than the femoral joint, and the spoon-shaped tarsus is a little longer than the two preceding joints combined.

Several specimens of both sexes from the District of Columbia, Long Island, N. Y., New Hampshire and Tennessee.

Prodalia, nov. genus.

Cephalothorax longer than broad, anteriorly half as broad as in the middle region; p. cephal. prominent, high and rounded; clypeus truncate; no median fissure.

Eyes 8 in two rows, anterior row close to the margin of the clypeus, straight, shorter than the posterior; A. M. E. very small, much smaller than the obliquely set A. L. E.; the distance between them equals their diameter; distance between A. M. E. and A. L. E. smaller. Posterior row strongly procurved, so that the P. L. E. are contiguous to the A. L. E., while the P. M. E. are at least the length of their diameter apart from the A. M. E. Distance between the P. M. E. greater than that between them and the P. L. E.

Mandibles rather long and stout, thicker than femur I; vertical, parallel, but at the inner side at apex obliquely cut; claw small and weak.

Maxillæ longer than broad, subparallel, straight, hardly inclined over labium; anteriorly slightly rounded.

Labium two-thirds the length of maxillæ, square, a little broader than long, and slightly broader at base than at the rounded apex.

Sternum very prominent, cordiform, anterior margin truncate; drawn out considerably between coxæ IV.

Legs 4. 1. 2. 3, weak and short, anterior and posterior of equal length; without spines. Calamistrum about half as long as metatarsus IV; tarsal claws three, superior with six teeth, inferior very strong, without teeth.

Abdomen oval, truncate at base. Cribellum long, narrow and undivided; spinnerets stout, short, of equal size, superior two-jointed.

Prodalia foxii, nov. species. Plate I, fig. 5.

Cephalothorax long, 0.5 mm.; abdomen long, 1.3 mm.; total length, 1.8 mm. Leg I and IV, 2 mm. long; II, 1.5 mm.; III, 1.3 mm.

Cephalothorax yellow testaceous; trophi, sternum and legs pale yellow; abdomen grayish white with dark gray markings at the dorsum, consisting of about five transverse angular lines pointing to the front; underside pale, region before the spinnerets darker; abdomen and legs sparsely covered with long, darker pubescence.

The A. L. E. and the P. M. E. and P. L. E. form a cluster as in *Neophanes*, but in *Prodalia* two minute A. M. E. are present. The spaces between these eyes are filled out by black pigment. The mandibles have no claw groove, but a short row of dark bristle-like hairs running longitudinally over the front.

This spider and *Neophanes* belong undoubtedly to the family *Dictynidæ*; it was collected by Dr. Fox in Tennessee, where it seems to be rare.

Usofila, Keyserling, nov. genus.*

Cephalothorax a little longer than broad, anteriorly moderately narrower than in the middle region; p. cephal. prominent, strongly arched; clypeus high; median fissure indistinct.

Eyes 6 in two rows, anterior row consisting of four eyes, shorter and slightly recurved, the two M. E. contiguous; the two eyes of the posterior row closely behind the lateral of the first row.

* Count Keyserling, who examined this interesting spider, named it *Usofila*, and intended to publish the description in the eighth number of his "Neue Spinnen aus Amerika," but was prevented by his untimely death. I received from his publishers, amongst his other manuscripts, also the description of *Usofila*, and present it herewith in translation with that of the only species, *U. gracilis*.

Mandibles small and weak, vertical, not much arched in front, obliquely truncate at the inner side of apex; claw weak.

Maxillæ not quite twice as long as broad, inclined over labium, at the outer side a little emarginate, at apex obliquely truncate.

Labium triangular, a little longer than broad, rounded at the tip, and about two-thirds as long as the maxillæ.

Sternum flat, triangular, longer than broad.

Legs 1. 2. 4. 3. very long and slender, without spines, but sparsely provided with fine hairs; three tarsal claws.

Abdomen globose, four stigmata at the ventral side; spinnerets short and equal.

Usofila gracilis, Keyserling, nov. species. Plate I, fig. 6.

♂ Cephalothorax long,o, 5 mm.; abdomen long, 0.6 mm.; total length, 1.1 mm.

Leg i	Femur	1.2	Patella and Tibia	1.4	Metatarsus and Tarsus	1.4	Total	4 mm.
" ii	"	1	" "	1.2	" "	1	"	3.2 mm.
" iii	"	0.8	" "	0.9	" "	0.8	"	2.5 mm.
" iv	"	1.1	" "	1.0	" "	1.2	"	3.3 mm.

Cephalothorax, palpi and legs yellow; abdomen dirty white, with a few long darker hairs at the dorsum.

Cephalothorax hardly longer than broad; in front about half as wide as in the middle; posteriorly broadly rounded. Seen from the side the dorsum is highly arched, and the highest point is a little behind the eyes; the median fissure absent; clypeus as high as the length of the mandibles.

Eyes in pairs, forming two rows, the anterior row a little recurved; the two median eyes contiguous and not much more than their diameter separated from the also contiguous L. E.

Mandibles diverging, rather porrected and weak; obliquely truncate on the inner side near apex. Claw in the male long and thin.

Maxillæ about two-thirds longer than broad, curvatedly inclined, partly embracing the triangular labium..

Sternum triangular; narrower in the male than in the female.

Legs very long and slender, sparsely provided with short pubescence. Three tarsal claws. The patellar joint of the male palpi shorter than the tibial joint, and both together longer than the very slender and slightly bent femur. The tarsal joint emarginate at the underside, near the base, shorter than the pyriform prominent bulbus, which terminates in a curved projection.

Abdomen hardly longer than broad, globose, projecting a little over the spinnerets, of which the inferior pair seems to be a little thicker than the superior.

One male and several undeveloped females from Alabaster Cave, El Dorado Co., Cal.

The female resembles the male; the legs are considerably shorter. On the abdominal apex, just above the spinnerets, is a round white spot. The four stigmata are distinctly visible in one female, which is a little darker colored than the others.

The three last-named genera belong, no doubt, to well-known families; *Neophanes* and *Prodalia* will find their place in the *Dictynidæ*. The presence of a calamistrum and cribellum, the elevated, rounded head and the form of the maxillæ and labium place these genera in close relationship to the genus *Dictyna*.

The genus *Usofila* was placed by Keyserling in the *Dysderidæ* on account of the four ventral stigmata and the six eyes.

EXPLANATION OF PLATE I.

Fig. 1—*Homalonychus selenopoides* Marx: *a*, female, enlarged 2 times; *b*, eyes seen from above; *c*, maxillæ, labium and sternum; *d*, epigynum; *e*, tarsus; *f*, auxiliary claw.

Fig. 2—*Habronestes americanus* Marx: *a*, female, enlarged 2 times; *b*, face; *c*, maxillæ, labium and sternum; *d*, epigynum.

Fig. 3—*Lutica maculata* Marx: *a*, female, enlarged 3½ times; *b*, face; *c*, maxillæ, labium and sternum; *d*, spinnerets.

Fig. 4—*Neophanes pallidus* Marx: *a*, female, enlarged 12 times; *b*, face; *c*, maxillæ, labium and sternum; *d*, epigynum; *e*, male palpus, from the side; *f*, the same, from above.

Fig. 5—*Prodalia foxii* Marx: *a*, female, enlarged 12 times; *b*, face; *c*, maxillæ, labium and sternum; *d*, epigynum.

Fig. 6—*Usofila gracilis* Keyserling: *a*, male, enlarged 15 times; *b*, maxillæ, labium and sternum; *c*, male palpus; *d*, female, enlarged 15 times; *e*, maxillæ, labium and sternum of female.

Considerable discussion followed relating to the advisability of erecting monotypical families. The conclusion reached was that generally it would be better to give isolated species sub-family importance in the nearest related existing family.

Mr. Linell then gave an account of some observations which indicate the identity of *Megapenthes limbalis*, Herbst, and *M. granulosus*, Melsh., hitherto considered to be distinct species. He had found these beetles *in coitu* on several occasions, and as only males of *limbalis* and females of *granulosus* have been known previously, the identity of the two forms was fully established. The males, having been first characterized, will give the name to the species.

Mr. Schwarz stated that errors, such as the one corrected by Mr. Linell, could only be discovered by field observation.

Prof. Riley thought that the occurrence of females only of the one and males of the other might be taken as evidence of the identity of the two forms, when these occur under similar circumstances.

In connection with the discussion of sex in insects, Prof. Riley called attention to Mr. Blanchard's paper on double and triple cocoons of silk worms, in which the author supposed that the larvæ had associated on sexual grounds, as the moths hatching from these cocoons were largely males and females. Prof. Riley thought that the exceptions were sufficiently numerous to contradict this theory. Sex, he stated, is almost, if not entirely, wanting or undeveloped in larvæ; and he also stated that the production of males or females at will, by starving or over-feeding, as held to be possible by Mrs. Treat, was entirely out of the question. If starving were attempted, the female larvæ requiring most food would more frequently perish, and the males would necessarily predominate. In the case of the orders of insects in which metamorphosis is incomplete, especially in the pupal stage, the sex could be easily determined.

Mr. Howard stated that the ovaries are readily distinguished from the testes in the later stages of some lepidopterous and other larvæ.

March 6th, 1890.

Eight persons present. President Marx in the chair.

Dr. Fox stated that Mr. E. W. Maslin, of California, had lately transmitted to him a copy of the "*Citrus Belt*," of November 7th, 1889, containing an article by Mr. Maslin on "Fig Culture and Seedling Smyrna Figs."

Mr. Schwarz explained that the paper referred to repeated attempts on the part of Mr. Maslin to raise in California the Smyrna Fig from seedlings. The trees grew admirably, but

in spite of all care in cultivation the fruit remained small and contained no seed at all, or only a few. Such results were to be foreseen, for the Smyrna Fig in its native home has, since time immemorial, been cultivated with caprification. Its fruit owes its superiority in quality solely to the fact that the seeds are fertilized by the fig-insects. If the tree is cultivated without caprification, a change in the character of the fruit necessarily takes place; and that this change is to the worse and not to the better, is shown by Mr. Maslin's experiment with Smyrna seedlings, as well as by previous attempts made in California with layers and cuttings. If the California fruit-growers are desirous of raising the genuine Smyrna fig in their State they must introduce from its native home the Caprifig, containing living fig-insects in its seeds. This would be no difficult task, nor is there any reason to doubt that the fig-insects could be easily acclimatized in California.

Mr. Howard remarked that Mr. C. E. Hawley had told him that the Peruvian Figs were the finest he had ever eaten, and that these were grown without the aid of caprification. Mr. Hawley is now endeavoring to introduce them into the United States.

Mr. Schwarz exhibited the following species of Coleoptera, which must be added to the North American fauna: *Lathridius (Coninomus) nodifer*, Westw. (family Lathridiidæ), previously known from Europe and New Zealand, and lately found along the Pacific Coast from Washington to Middle California, and also in the District of Columbia; *Actinopteryx fucicola*, Allib. (family Trichopterygidæ), recently mentioned by Flach as inhabiting North America, and taken on the beach near Fortress Monroe, Va., by Mr. Schwarz; *Arrhipis lanieri* Guér. (family Elateridæ), and *Probatius umbratilis*, Duv. (family Cerambycidæ), both described from specimens collected in Cuba, were found at Cocoanut Grove, Dade Co., Fla.

Mr. Schwarz also exhibited specimens of *Temnochila hubbardi*, Lev., and *Teretriosoma hornii*, Lewis, recently described in European journals from the semi-tropical region of Florida, and pointed out the secondary sexual characters of

the latter species, consisting of a row of long hairs in the male on the first antennal joint. He called attention also to Dr. Horn's recent revision of the North American species of *Ochthebius*, and spoke of the remarkable geographical distribution of these aquatic insects. Species of this genus occur in Florida, western Pennsylvania, Vermont, Michigan, and throughout the western part of the country, but not a single specimen had hitherto been found east of the Alleghanies from Maine southward to Georgia.

Mr. Marlatt presented the following communication :

THE XANTHIUM TRYPETA.

Trypeta æqualis Lw.

By C. L. Marlatt.

Trypeta æqualis Loew : Monog. Dipt. N. A., I, p. 86; Tab. II, f. 20, 1862 (description of male).

Trypeta æqualis Loew : Monog., etc., III, p. 308; Tab. X, f. 20, 1873 (description of male and female; referred to sub-genus *Euaresta*).

Trypeta (*Euaresta*) *æqualis* Lw. Osten Sacken : Cat. Dipt. N. A., 1878, p. 194.

Trypeta (*Euaresta*) *æqualis* Lw. Osten Sacken : Bull. U. S. Geol. Surv. Ter., Vol. III, No. 1, p. 345 (species mentioned as very like *T. æqualis* Lw.).

The species of *Xanthium* are such notorious weeds, and are so widespread and troublesome, that a knowledge of any important insect enemy becomes of interest. The enemies of noxious weeds, whether insects or fungi, are, I am aware, of second-rate economic importance, as it is only in connection with careless and negligent culture that such plants are allowed to multiply, and thus furnish opportunity for the increase of their insect and other enemies. That such plants are and always will be allowed to flourish, renders any natural check important. This consideration, together with the scientific interest attaching to a knowledge of the habits of the insect, leads me to put the following facts on record.

Some years ago my attention was drawn to the fact that the larvæ of a dipteron, bred in the seeds of a cockle-bur, or *Xanthium*, by Mr. W. T. Swingle, of the Kansas State Agricultural College at Manhattan, Kansas, who came across the larvæ while making some studies, I believe, of the germination

of the seeds of this plant. I afterwards repeatedly found these larvæ at Manhattan and vicinity, but failed to rear any of the parent insects, although efforts to do so were continued for several seasons.

In November, 1889, the seeds of a *Xanthium*, probably *X. canadense*, which occurs abundantly in the vacant lots in Washington and on the Potomac flats, etc., were found to be infested with a larva apparently identical with those previously noted in Kansas. Better success was had in breeding these larvæ, and from seeds collected in the fall of 1889 and spring of 1890 the mature insects named above were secured. The exact date of emergence was not noted—the flies being found dead in the breeding cage about the 1st of September.*

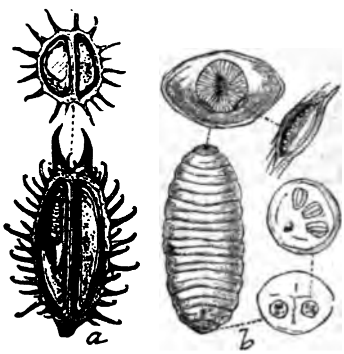

FIG. 1.—*Trypeta æqualis: a*, *Xanthium* bur in longitudinal and cross section, showing work of larva; *b*, larva enlarged, with details of anterior and posterior extremities still more enlarged (original).

The perfect insect appears, without doubt, chiefly in August, during which month the burs of the *Xanthium* are just forming, and can be easily pierced by the female in ovipositing.

In no case was more than one larva found in a bur, which normally contains two seeds separated by a distinct and strong septum. The seed proper of the *Xanthium* is rich in oil, and possesses somewhat of the characteristic pungent odor of the plant.

The larva inhabits and feeds on this seed, which, in most instances, was nearly consumed. (See Fig. 1, *a*.) Full larval

*The rearing and determination of this insect was recorded at the October, 1890, meeting of the Society.

growth is attained late in the fall or in early winter, after which the larva remains unchanged until shortly before the appearance of the fly. Examination in June and July showed no alteration in the larva. The fly must escape from the tough bur with difficulty, and probably only succeeds when the latter is softened by moisture or is opened by the germination of the adjacent uninjured seed. It is probably by the latter means chiefly that the fly effects its escape, and this affords an explanation of the fact noted that the parent insect oviposits in but one of the two seeds contained in a bur.

The larva (Fig. 1, *b*) is apparently 13-jointed, and when full-grown is about 5 mm. long by 2 mm. wide, and is considerably flattened. The general color is light straw-yellow and

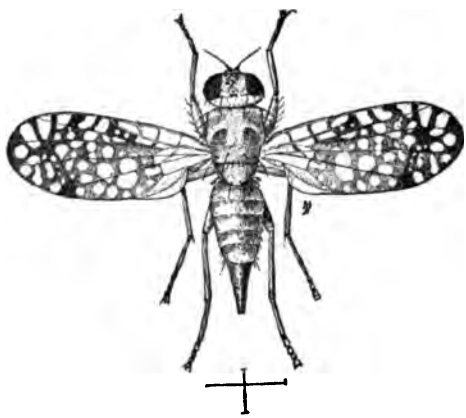

FIG. 2.—*Trypeta æqualis*: female (original).

the surface of the body is smooth and shining. The first segment is plate-like, with radiating ridges, which form the central oval opening, as shown at Fig. 1, *b*; the edges of the radiating ridges are dark brown and the oral opening is almost black. The thoracic stigmata are 8-branched and are situated in oblong excavations at the upper (dorsal) corners of the plate. A dark area surrounds the stigmata. The character of the anal stigmata is shown in the illustration. The anal opening is apparently on the 11th segment. All the larvæ examined, including those collected early in the fall and apparently not full-grown, had the general form indicated in the description—which, however, seems to be half-way between the larval and pupal state as known in allied flies.

The mature insect, the female of which is represented at Fig. 2, is pale yellowish in color with whitish pile and bristles

and has the wings marked with brownish black, as shown in the figure. The ovipositor of the female is brownish and as long as the last three abdominal segments taken together.

An extended and general discussion followed relating to the unusual abundance of insects during the past winter. *Sitones hispidulus* had been observed by Mr. Schwarz all winter in enormous numbers in the grounds of the Agricultural Department, on the pavements, etc., indicating that it did not go into winter quarters at all. The abundance of plant lice had been particularly noted by several members.

Mr. Marlatt also presented a note on the food habits of a large, handsome Buprestid (*Psiloptera drummondi*, L. and G.). He stated that in central Kansas this insect occurred abundantly in late summer and early fall on the common hillside plant *Petalostemon multiflorus*, usually resting on the spikes of whitish flowers, but was also frequently observed to gnaw the bark just below the spikes, sometimes denuding the stem for a considerable distance. The beetle was never found on other plants, and it was therefore surmised that its larval stage might be passed in the large perennial root of the *Petalostemon*. Large numbers of the roots of this plant were dug up and examined carefully, but no evidence of such habit could be found.

In the discussion Mr. Schwarz said that nothing was known of the breeding habits of this or allied genera. He thought that the larvæ would be more cylindrical than with other Buprestid larvæ.

Mr. Townsend read "Some Notes on Acrididæ in the vicinity of Constantine, Michigan," of which he furnished the following abstract:

A color variety of *Melanoplus femur-rubum*, Deg., taken September 6,* has the head, face, thorax and upper parts of hind femora of a soft crimson purple. 1 ♀.

First specimen of *M. bivittatus*, Scudd., was taken August 7. Not common. *Encoptolophus sordidus*, Scudd., first seen September 6, the two sexes appearing in nearly equal numbers.

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*The September 6 above referred to was the first pleasant day after a week of rainy weather.

The peculiar stridulation indulged in on the wing was noticed to be dispensed with when the sun became low, individuals at that time flying silently, while the stridulation is invariably exhibited in flight in the strong heat of the sun. Not rare. Seen as late as October 4.

A pair of *Chloëaltis conspersa*, Harris, was taken *in coitu* September 7, the first specimens being seen September 6. Uncommon.

Tettigidea polymorpha, Scudd., *Tettix triangularis*, Scudd., and *granulatus*, Scudd., are frequently found hibernating as imagos under logs, sticks, stones, bark, and even found in those situations in the spring and late in summer.

Mr. Mann queried if dates of first appearance might not have some relations to the dates of going out into the field. Mr. Townsend showed, however, that in going to and from work he had had daily opportunity to make observations. Mr. Schwarz said that any date was important and valuable as furnishing a basis for future observations.

APRIL 3RD, 1890.

Nine persons present. President Marx in the chair.

A letter of resignation from Dr. R. W. Shufeldt was read, and the resignation was accepted.

Mr. B. E. Fernow was elected an active member of the Society.

Dr. Fox read a paper on the genus *Ceratinella* (*Erigone*). He showed drawings and specimens of all the known American forms except *C. brunnea** Em. and *C. pygmæa* Em., and also described the following new species:

NEW NORTH AMERICAN SPECIES OF THE GENUS ERIGONE.

BY DR. WM. H. FOX.

***Erigone* (*Ceratinella*) *alba*,** n. sp.

♂ Closely resembling *C. fissiceps*, but distinguishable by its lighter color and very small palpus. Length, 1.5 mm.

* I have since examined a specimen of *C. brunnea*, thus leaving *C. pygmæa* the only one unknown to me.—WM. H. FOX.

The color is nearly white, and only slightly darker in eye region, not extending back on cephalothorax as in *fissiceps*.

Femur of male palpus long and very narrow, not enlarged at distal end. Palpal organ much as in *fissiceps*, but proportionally smaller.

Locality: District of Columbia; August.

***Erigone* (*Ceratinella*) *alticeps*,** n. sp.

♂ Head abruptly raised from thoracic portion; groove between median eyes reduced to a nearly horizontal fold, thus bringing the P. M. E, nearly vertically over A. M. E.

Tibia of male palpus short and rather broad. Tarsal hook short, broad, bent nearly at right angles at its end, with a prominent tooth at about its middle. Palpal organ as in *fissiceps*.

Color, orange. Length, 1.5 mm.

Locality: District of Columbia; April. Three males.

***Erigone* (*Ceratinella*) *melanocnemis*,** n. sp.

♂ Head as in *emertonii*, but P. M. E. less than diameter apart (more than diameter in *emertonii*).

Palpus much smaller than in emertonii. Tarsal hook, seen from above, extremely narrow; from the side, broad, bent at right angles at tip, with prominent tooth. Tube of palpus small, and without the long curved process of *emertonii*.

♀ Much like *fissiceps*, but epigynum with a broad plate in center, with openings on each side.

Color, orange; tibia of fourth legs much darker than other joints. Length, 1.5 mm.

Locality: District of Columbia; May and October.

***Erigone* (*Ceratinella*) *parvula*,** n. sp.

♂ Size, 1 mm. Head rounded and elevated. Cephalothorax falls off abruptly at posterior half. Abdomen with dorsal and anterior shield, the latter almost entirely above pedicle of body.

Palpus, patella as broad as long; tibia broader than long, with tooth in center and short process at outer side. Palpal organ simple, tube coiled upon itself at the end.

Colors, soft parts gray, hard parts dark brown; legs, yellowish brown.

Locality: Hollis, N. H.; August.

***Erigone* (*Ceratinella*) *tibialis*,** n. sp.

♂ Resembles *C. minuta*, but differs markedly in the palpus and size. Head narrow, raised; eyes equal, much more than diameter apart.

Tarsal hook very long, strongly curved, with strong tooth at its first third. Palpal organ resembles *fissiceps*.

Color, red-brown, darker around eyes. Legs, light yellow. Size, 1.5mm.

Locality: District of Columbia; March.

A collection of these spiders was exhibited, together with drawings of the specific characters.

Dr. Marx stated that the group included many species, and was a very difficult one to classify, as there were good characters only in the male sex.

Mr. Schwarz said that the distinctive male characters were constantly being used to distinguish species in other groups of insects where the females could not be separated.

Mr. Schwarz then read the following paper:

LABELING SPECIMENS.

By E. A. Schwarz.

Without a collection valuable observations on insects can no doubt be made, but they will always remain isolated and of limited value without the means for determination and comparison afforded by a collection. A good and serviceable collection, however, does not consist merely of an accumulation and arrangement of specimens in boxes or vials, but also of the record to be attached in some way to the specimen, and which is to inform us regarding the name of the insect, the locality, mode of life, authority for determination, etc.—in short, everything that may belong to the history and natural history of the specimen.

This information can be recorded and made available for practical purposes by the following systems: 1st. By numbers attached to the specimens, and which refer to notes kept and arranged in various ways; 2nd. By written or printed labels attached to the specimens; 3rd. By a combination of these two systems.

For an economic or biological collection the labeling system alone is not practicable; for the information derived from the study and observation of the life-history and economy of a single species or specimen usually covers so much ground that it cannot be written on one or several labels attached to the specimen in the collection. A numbering system is here indispensable, or, still better, a combination of the two systems, since certain shorter information, *e. g.*, locality, date of capture or breeding, etc., can conveniently be written on labels attached to the specimen.

A systematic collection kept in alcohol, *e. g.*, a collection of Arachnida, is evidently well adapted to the labeling system; for the vials are almost always of a size sufficient to allow the

insertion of one or several large labels containing the full record.

I do not propose, however, to speak of alcoholic collections nor of the numbering system of an economic collection, but beg leave to offer a few and short remarks on systematic collections of dried specimens, which are by far the most numerous kind of collections in existence. For such collections the numbering system is evidently less desirable, for the usefulness of the collection as a means of reference and comparison would be greatly impaired by the loss of time involved in referring from the numbers on the specimens to the corresponding numbers of the note books. The labeling system alone is here advisable.

It is difficult to give general rules for what ought to be considered a correct method of labeling specimens: too much depends upon individual taste and experience, and on the purpose for which a collection is intended by its owner. There are hardly any collections which have too many labels, but most collections which I have seen have too few and too indefinite labels. As a general rule it may be said that the labels should be plainly written, or printed whenever practicable, so that they are intelligible to everyone. Some collectors are in the habit of using labels of various forms and colors, and more or less covered with mysterious hieroglyphs to which the owner alone possesses the key. In the course of time they are apt to become just as unintelligible to the owner as to the outsider, and the specimens usually lose much of their value if the collection changes hands. The labels should be as small as possible, or at least proportionate to the size of the specimen. The importance of this rule will have been experienced by all who frequently handle the specimens of their collections. If the labels are disproportionally large the lower ones cannot be read without taking them off the pin, and further, it becomes a matter of great difficulty to handle the specimens without breaking, or at least endangering, the adjoining specimens. It may be urged that the latter difficulty can be obviated by placing the specimens sufficiently apart to allow the use of larger labels, but the necessity of and advantage in economizing space are too evident. A compactly arranged collection will always be found more useful for working purposes than a collection in which much space is wasted.

The following labels should be employed in a collection:

1. *The locality label.*—This should be as explicit as possible, for a great deal more can be learned of a specimen with an exact indication of locality. The importance of this point has often been pointed out by others, so that it is hardly necessary

to add anything further. I only regret to see that so many of our entomologists still use the old and indefinite State labels originally issued by the Smithsonian Institution, and unfortunately reprinted by the Brooklyn Entomological Society. Some entomologists who are aware of the insufficiency of these labels still use them, but add in writing various signs thereon to give a more definite indication of locality, *e. g.*, one of the four corners is marked with a red or black dash, to indicate respectively the northern, southern, eastern or western part of the State. It is, however, at once apparent that this is a much less satisfactory mode of labeling than the use of definite localities, *e. g.*, Los Angeles, Cal., instead of Southern California; Lake Worth, Fla., instead of Southern Florida.

2. *Date of capture.*—This is very useful, and sometimes quite important in various ways. It indicates at what time additional specimens of some rare species may be secured; it greatly helps to construe the life-history of species which cannot be bred in captivity; and in some instances, *e. g.*, the Cerambycidous beetles *Cyllene picta* and *robiniæ*, assists in correct determination. It can be abbreviated in various ways according to individual taste, and conveniently written on small labels or combined with other labels.

3. *Label to indicate the sex.*—Since the sexual differences have recently acquired such importance for the distinction of species, this label will be found of great convenience and time-saving by all entomologists. The well-known signs for male, female and worker, printed in convenient form, are well adapted for our collections. They need not to be attached to specimens of large size where the sexes can be distinguished at a glance; and further, it has been found out by experience that only one sex, the male, needs to be labeled, it being understood that all not-marked specimens are females or species in which the two sexes cannot be distinguished externally. In the few families containing more than two sexes each specimen should be labeled according to sex.

4. *Name of the collector.*—This will be found of importance in many instances, *e. g.*, a specimen simply marked "Arizona" does not furnish much information, but if by another label it is indicated that the specimen has been collected by Mr. Morrison, everyone knows that there is some doubt regarding the locality. Those entomologists who are active in the field usually do not attach their own name to the specimens collected by themselves, and they are, of course, always able to recognize in their collections these specimens. Still, this practice should be discontinued, since the record is lost when the collection comes into other hands. Specimens received in

exchange or by purchase should be labeled with the name of the person from whose collection they come, so as to preserve, as much as possible, the history of the specimens.

The above mentioned labels should be on every specimen in a collection, while the following are to be attached only to certain specimens:

5. *Name of the species.*—Most of our collections are now arranged in vertical columns, and this label can either be attached to the first specimen of a set or separately pinned above or below the set of specimens belonging to the same species. The latter method is largely used in collections of Macrolepidoptera or other large-sized insects, but I prefer the first-mentioned method, viz: to attach the name to the pin of the first specimen, which should be the best determined or the best marked specimen. The substitution of check-list numbers for written or printed labels is by no means to be recommended.

6. Typical specimens, *i. e.*, such from which a description has been drawn up and published, should be designated by a special label written by the author himself.

7. Specimens which have been determined by an authority in a special group or order should be furnished with a special label. If such authority returns specimens sent him for determination with labels in his own handwriting, they should be left on the specimens; if too large, they have to be folded.

8. Special labels, which either refer to the food-plant or life-history of the specimen, or which indicate some peculiarity of the specimen, *e. g.*, a monstrosity, a hermaphrodite, etc. This is the only label which, in my opinion, will be found necessary to be replaced in some instances by a number referring to notes kept in note books with corresponding number.

As a matter of course it will never be found necessary to use on a specimen all of the above-mentioned labels; most private collections will contain few, if any, types; few specimens will have been determined by authorities; and to few specimens the collector will have notes worth preserving regarding food-plants or habits.

As to the remaining labels, their number can still be reduced by a system of combination. A combination label which has given general satisfaction to all to whom it has been communicated is a two-line label printed in diamond type, on heavy writing paper. The upper line consists of the name of the locality, *e. g.*, "Washngtn" (a name consisting of more than eight letters to be abbreviated), and the lower line has at the right hand corner "DC" (interpunctuation and spacing to be avoided so as to save space). This leaves on the second

line sufficient room for inserting the date, which can be quickly and neatly written with ink if the labels are printed in columns of ten or more repetitions. The label thus combines locality with date of capture. Or the upper line reads "Arizona," and the lower line "Morrison," the label thus combining locality with name of the collector. In large specimens, *e. g.*, most Lepidoptera, many more labels can, of course, be conveniently combined into one. In short, it will be found that even in a very carefully labeled collection the number of labels on most specimens averages not more than two or three.

I am far from pretending that the above remarks contain anything that has not appeared in print before, but I was prompted to offer them because the subject has been but slightly touched or entirely neglected by American writers on arranging insect collections; and further, because I know from experience that many of our collectors do not sufficiently appreciate the fact that the value and usefulness of a collection is greatly enhanced if the specimens are carefully labeled, and that this can be attained by very little additional expenditure of time and money.

Mr. Mann assented generally to the scheme presented by Mr. Schwarz, but thought that a three-line label would be preferable.

Mr. Schwarz said that three-line labels would be troublesome in the case of minute specimens mounted on triangles.

Prof. Riley, while agreeing generally with Mr. Schwarz, stated that the method of labeling would depend on the character of the collection. He held that there was no particular disadvantage in a large label or in folded labels. In visiting foreign collections he liked to use on the specimens identified large labels of thin paper that would contain a good deal of information and could be folded up into small compass. Square labels were not thought to be necessarily awkward. He stated that he would always retain the provisional number attached to specimens sent to specialists to be identified, and these specimens should also bear the name of the determiner and the date of determination so that it would be possible to refer to letters, etc. He further stated that the reverse of the label might be employed for notes relating to food-habits, etc. With reference to the numbering of specimens to refer to notes

he favored using red ink on the labels to distinguish the numbers referring to biological notes. He considered sex labels important even in the case of large specimens. He would pin the name of the species to one of the specimens rather than place it above or below the series.

Mr. Schwarz said that his paper dealt chiefly with the labeling of the private collections of specialists, and that it was not his intention to speak of large public museums, where various other points had to be taken into consideration.

Dr. Marx stated that he used onion-shell paper in labeling spiders, writing with water-proof ink—such as Higgins' Drawing Ink—and placed the label in the vial with the specimens. There was in this method some danger of the specimens being injured by the settling of the labels against them, but this could generally be avoided. He used a cork stopper in preference to rubber stoppers. The following preserving fluid is used by him: Glycerine and Wickersheimer fluid, 1½ ounces each, well mixed with three ounces of distilled water, and then 30 ounces of alcohol (95%) added. Alcohol previously used for preserving spiders, and in which, therefore, some of the fatty matter of the specimens is dissolved, is preferable to pure alcohol, but in this case a smaller quantity of distilled water should be added. This liquid keeps the specimens flexible, preserves their color, and never evaporates entirely.

Prof. Riley preferred the rubber stopper, as cork stoppers allowed evaporation, and would write the label in pencil, which was practically permanent. Concerning water-proof inks, he stated that the oak-gall ink was the best.

Mr. Mann explained a convenient abbreviation for month labels, Ja, F, Mr, Ap, My, Je, Jl, Ag, S, O, N, D, and said that in numbering specimens to be determined he would use the same numbers but once.

MAY 1ST, 1890.

Nine members present. President Marx in the chair.

The committee having in charge the preparation of a list of the insects occurring within the District of Columbia made a partial report.

It was moved by Mr. Howard that the name of Mr. Townsend be added to the sub-committee on Diptera, and that of Mr. Marlatt to the sub-committee on Hymenoptera.

The prosecution of the work was urged by Prof. Riley, and in the general discussion it was shown that considerable work had already been done.

Mr. Townsend then read the following paper:

HEMIPTERA COLLECTED IN SOUTHERN MICHIGAN.

BY C. H. TYLER TOWNSEND.

During my collecting in Michigan I made a small collection of Heteroptera and Homoptera, which is now in the National Museum. Eighty-five or ninety species of Heteroptera were collected in the neighborhood of Constantine, which this list is intended to record. About half of these were very kindly named for me by Mr. Uhler some years ago. The remainder, collected since then, have been worked over with the aid of Prof. Riley's identified material in this group. The localities in parentheses are those given in the Uhler list.

CORIMELÆNIDÆ.

Corimelæna atra Am. and S.

nitiduloides Wolff. April 18, a live, unmutilated specimen taken in the rubbish on the top of an ant-hill belonging to *Formica schaufussi*. This species is commonly, however, with the preceding and the next two species, found on flowers.

lateralis Fab.

pulicaria Germ.

PENTATOMIDÆ.

Podisus cynicus Say.

placidus Uhler. Flowers of golden rod, September 15.

spinosus Dall. Larvæ, probably this species, often found with imagos on various plants in early summer.

Brochymena arborea Say. (Atl. St.)
annulata Fab. I have also taken this species in Lawrence, Kansas. (Atl. St.)
Neottiglossa sulcifrons Stål. (S. St.)
Cosmopepla carnifex Fab. Numbers flying in late summer.
Mormidea lugens Fab. On oak leaves, May 23.
Euschistus fissilis Uhler.
servus Say. On dandelion bud, May 16.
tristigmus Say. On holly-hock seed-cups, August 7.
variolarius Pal. Beauv. About raspberry bushes in gardens, from May 30 to July 13, both nymphs and imagos on latter date on the ripe fruit (see Insect Life, II, p. 44). Nymphs and imagos on mullein stalks and in fields through July to September. A specimen taken on a mullein stalk September 27 was ferruginous above and greenish-yellow below.
Liodcrma ligata Stål. ? Nymph referred to this species.
Peribalus limbolarius Stål. The old *Cimbex platychilus* Uhler appears to be a synonym of this.

CORÆIDÆ.

Euthoctha galeator Fab. On various weeds in May and June.
Anasa tristis Deg. The matured insects become active in sunny weather about the last of August.
Alydus eurinus Say. Flying, July to September.
quinque-spinosus Say.
Protenor belfragei Hagl.

BERYTIDÆ.

Neides muticus Say.
Corizus lateralis Say.

LYGÆIDÆ.

Nysius angustatus Uhler.
Ischnorhynchus didymus Zett. Flying, in May.
Geocoris punctipes Say. On soil of garden, June 3 to 14. (S. St.)
bullatus Say. On soil of garden, June 12.
Ligyrocoris sylvestris Linn. A pair *in coitu*, July 28, on flower of *Rudbeckia* sp., and one on a leaf of *Asclepias tuberosa.*
Myodocha serripes Oliv.
Megalonotus unus Say.
Peliopelta abbreviata Uhler.
Melanocoryphus bicrucis Say. Rather common.
Lygæus turcicus Fab. Common on *Asclepias tuberosa*, the stems and pods of which it punctures (see Entom. Amer., III, 53-55).

CAPSIDÆ.

Brachytropis calcarata Fall.
Miris affinis Reut. In grass, June 4.
Hadronema militaris Uhler.
Oncognathus binotatus Fab.
Lygus pratensis Linn. On cowslip flowers April 30; flying, June 10 and July 14.
Tropidosteptes cardinalis Uhler. One specimen, June 5.
Pœcilocapsus lineatus Fab. Numerous on catnip, June 24.
do. Bright red color variety.
goniphorus Say.
affinis Reut.
marginalis Reut.
sp.? One on potato plants, June 11.
Capsus ater Linn.
n. sp.? One taken June 8, in grass. This was the first specimen of the season. Two or three others taken in former years.
sp.? Flying, in June.
Hoplomachus mærens Uhler MS. Not in the Uhler list.
Stenidea scutellata Uhler. Flying, in May and June. Not in Uhler list
regalis Uhler. Not in Uhler list.
A small blackish, unnamed *Capsid* was taken flying, July 3, and on leaves of raspberry, July 13. A still smaller, almost minute, unnamed *Capsid* was taken on garden soil June 8.

ACANTHIIDÆ.

An unnamed *Anthocorid* was taken on garden soil, May 5.
Acanthia lectularia Linn.

TINGITIDÆ.

Piesma cinerea Say. Flying, June 1.
Corythuca ciliata Say?

ARADIDÆ.

Aradus robustus Uhler.
acutus Say.
crenatus Say. (S. St.)
rectus Say. Flying, April 21.

PHYMATIDÆ.

Phymata erosa H. Sch. (Mex.)
acutangula Guer. (W. Ind.)
wolffii Stål.

NABIDÆ.

Coriscus inscriptus Kirby. On garden soil, July 14. (Br. Am.)
ferus Linn.

REDUVIIDÆ.

Sinea diadema Fab.
Acholla multispinosa Deg.
Milyas cinctus Fab.
zebra Stål.
Diplodus luridus Stål. Not uncommon. A number were taken on foliage of oak sprouts in May, where they were doubtless looking for prey. *Euagoras viridis* Uhler MS., is a synonym of this species. Mr. Uhler, in his paper on the Heteropt. of the Harris coll. (Proc. Bost. Soc. N. H., XIX, 427), says he regrets that before meeting with Stål's description of *Diplodus luridus* he had sent specimens to his correspondents, both in this country and in Europe, labeled with the MS. name *Euagoras viridis.* (Mex.)

EMESIDÆ.

Emesa longipes Deg. One taken in October. (Atl. St.)
Cerascopus errabundus Say. One on window, May 31. (Atl. St.)

HYDROBATIDÆ.

Hygrotrechus remigis Say. *In coitu* on water, April 25. (Atl. St.)
Limnotrechus marginatus Say. One under drift-wood along river, April 25. One taken, May 28, on a tub of water a half mile from any pond or creek.

GALGULIDÆ.

Galgulus oculatus Fab. On submerged logs and sticks in edge of St. Joseph river, April 27.

NAUCORIDÆ.

Pelocoris femorata Pal. Beauv. Large numbers found April 27 on water-soaked logs in edge of St. Joseph river.

BELOSTOMATIDÆ.

Zaitha fluminea Say. On submerged logs. Not uncommon. (Atl. St.)
fusciventris Stål. In water or on water-soaked wood.
Belostoma americanum Leidy.

NEPIDÆ.

Nepa apiculata Uhler. One taken, April 27, under drift near the river. (Atl. St.)

Ranatra quadridentata Stål. A single specimen dipped up in a net from a stagnant pool in August.

NOTONECTIDÆ.

Notonecta americana Fab.

fabricii Fieb. Under drift or in water along the edge of St. Joseph river, in April. A pair *in coitu*, April 27, clinging to a water plant. I have also taken a variety of this species at Lawrence, Kansas. Not in Uhler list.

Plea striola Fieb. On submerged wood in St. Joseph river, April 27.

CORISIDÆ.

Corisa calva Say. In pond in April. In June in a barrel of water a long way from creek or pond.

Mr. Schwarz stated that the Heteroptera named were all widely distributed forms, and did not present any local feature, as would have been the case in a list of any other order of insects of equal length. The presence of the *Corimelæna* in an ant's nest, mentioned by Mr. Townsend, was stated by Prof. Riley to be without doubt an accidental occurrence. Mr. Townsend said that the specimen was taken from the rubbish on the top of the nest.

Mr. Dodge read a paper entitled "Artificial Silk," in which he described, as illustrated at the late Paris Exposition, the Count de Chardonnet's process of producing from cellulose an artificial fibre resembling in all its characters and uses the true silk of *Bombyx mori*. The cellulose experimented with was principally of cotton and the pulp of soft woods. The process of dissolving and converting the cellulose into a collodion, and producing from this fine threads closely resembling silk, was described, and the capillary tube, by means of which the threads are drawn out, was figured. Mr. Dodge said that the elasticity of the artificial silk is claimed to equal that of the natural silk, and in lustre and brilliancy the former is said to surpass the latter. It is also claimed that it can be produced at from one-third to one-fourth the cost of the natural silk. A sample of the silk was exhibited.

Prof. Riley said that this artificial silk attracted great attention at the Exposition, but was generally thought to be a

fraud. He had always been of the opinion, however, that man could duplicate nature in many of her products, as is illustrated in the manufacture of artificial silk, but he thought that this product would never compete with true silk.

Mr. Philip Walker said that the statement had been made to him in Paris that the artificial silk was only one-third as strong as true silk, but a much greater strength than that named was now claimed for it. He believed, however, that the single strand, as drawn from the capillary tube, could not possibly have the strength of the compound thread of the natural silk. He had been informed by the editor of the "*Silk Journal*" that a New York company had undertaken the manufacture of this silk. By recovering the solvents used in producing the collodion, which could doubtless be effected, the cost of manufacture would be greatly reduced.

The claim made by an Englishman that he had patented the same apparatus several years previously was also referred to.

Mr. Amory Austin thought that they were making silk of a single strand only, and Prof. Riley stated that so far as he knew this was the case.

The use of Ramie as an adulterant in the manufacture of black silk was mentioned by Mr. Walker, and Mr. Dodge exhibited a large series of stuffs manufactured from the Ramie fibre.

Mr. Howard said that Paul Camboué, of Madagascar, had again brought up the subject of the utilization of spiders' silk, and had recently corresponded with Prof. Riley on the subject. Mr. Howard thought that success was doubtful, in view of past failures.

Prof. Riley reiterated what he had said years ago relating to the possible use of other substances in lieu of the product of the domesticated silk-worm, mentioning the artificial silk noted above and silk of spiders; but he called attention particularly to the silk of the common bag-worm, *Thyridopteryx ephemeræformis*, hitherto ignored and neglected, which he said was firmer, stronger, and more easily spun as carded silk than that of most other silk cocoons, and which, in his opinion, could be made to take the place, in part, of other silk. The

fact that the insect was already widely distributed, removed the objection of spreading a pest, while within its range it could be readily propagated and controlled out-doors.

Mr. Ashmead said that the habits of insects, as in the spinning of spiders, could be used in classification if anatomical study indicated structural differences corresponding with the habits.

Mr. Dodge exhibited some unpublished drawings by Townend Glover, representing some of his best work.

JUNE 5TH, 1890.

Twelve persons present. President Marx in the chair.

Mr. Schwarz, on behalf the Publication Committee, stated that No. 4 of Volume I of the Proceedings was mailed to the correspondents of the Society on May 15th. He also called attention to the following typographical errors: on page 217, lines 5, 6 and 7 from top, substitute *labrum* for *labium;* the two notes on page 253 should be credited to Mr. Schwarz.

Mr. Ashmead, under general notes, announced the discovery of a genus of *Proctotrupidæ* new to the United States. The insect, *Iphitrachelus americanus*, is interesting, as furnishing a connecting form between the sub-families *Ceraphroninæ* and *Platygasterinæ*.

Mr. Schwarz exhibited a specimen of *Throscus pugnax*, which species is new to the fauna of the District.

Prof. Riley presented the following communication:

ON THE DIFFICULTY OF DEALING WITH LACHNOSTERNA.

BY PROF. C. V. RILEY.

Mr. Smith's studies, supplementing as they did Dr. Horn's, had resulted in the separation of the old form *fusca* into several species, which appeared more or less in succession, so that for a considerable period one or another species would be

present. I have recently been much interested in the attacks of these beetles on certain large trees, between thirty and forty feet high, which I transplanted last February to my new home, Sunbury, on Washington Heights. The trees specially attacked were a swamp oak and a chestnut, both of these trees being on the west of my residence. It so happens that the ground on the east was largely filled-in or made ground, while that on the west was, on the contrary, simply leveled off. This proved to be badly infested with Lachnosterna, and I have had great difficulty in preventing the entire defoliation of the two trees mentioned. The first species to appear was *L. hirticula*, and this was by far the most abundant and injurious species—the only other species noticed being *fusca*. It was evident from the beginning that the trees in question could not withstand the combined check resulting from the transplanting and the defoliation by the insects, so that I made strenuous efforts to thwart the latter. Smudges would doubtless have been efficacious if they could have been employed, but they were rendered impracticable owing, first, to the height of the trees and then to the prevalence of winds. With the assistance of Mr. Marlatt I made various experiments with insecticides, the chief of which were as follows:

(1) The trees were sprayed with a strong whale oil and tobacco soap solution about five o'clock in the evening. The spraying was satisfactorily and thoroughly done by means of the bamboo extension rod. A rain which followed during the night somewhat interfered with the experiment, but not until after the beetles had appeared and cut off a quantity of the leaves—showing the practical inutility of the application.

(2) London purple was applied at the rate of one pound to one hundred and twenty-five gallons of water, a stronger mixture not being advisable, owing to the tender character of the foliage, especially of the oak. This application was also satisfactorily and thoroughly made, not a leaf having escaped the spraying. There is no doubt but that this spraying resulted in the destroying of a considerable number of beetles, since two dead ones were found under the oak tree next day. It did not, however, limit the onslaught, and I made up my mind that it would be futile to endeavor to prevent the attacks of the beetle by any insecticide or other means at command, for the simple reason that the beetles would escape nightly from the soil, swarming more or less numerously around these two trees.

(3) I also endeavored to attract the beetles by lamps floa' ing in a tub of water having a scum of kerosene. The nu'

ber so attracted was so few in comparison with those that swarmed to the trees, that I have been led to reverse my opinion as to the value of this mode of destroying the beetles.

The experience has a certain value, and I would draw the following conclusions from it :

First. That it is impossible to protect large and tall trees from these beetles, when, as in this instance, these are issuing in large quantities from the ground immediately under and around the trees.

Secondly. It confirms the fact that these insects, as do so many other species, show a predilection for newly transplanted trees, in which the growth is less vigorous and the foliage more tender than it is in healthy forest trees.

Thirdly. My place is well isolated from other forest trees, the nearest woods being nearly half a mile away, with no other cultivated trees of consequence in the immediate vicinity. It occurred to me, therefore, that my trees suffered from a concentration of the beetles from other parts of the neighborhood on to these isolated trees, but I became convinced that such was not the case, but that they all came from the ground in the immediate vicinity. This conclusion was emphasized by the fact that another large oak not two hundred feet away, but on the east side of the house, and in ground from which no beetles issued, was scarcely touched. The practical inference is that if we can keep the ground in the immediate vicinity of our trees free from the larvæ, little injury will be suffered from the beetles.

The injury was not done through devouring of the leaves, but almost entirely through the gnawing of the petiole near the base or junction with the twig, the ground being covered each morning with fresh leaves, 95 per cent. of which had hardly been eaten at all. This preference for the gnawing of the petiole is, so far as I am aware, a new experience, and may be one of the habits peculiar to *hirticula*. It is an interesting point, which, I regret, time did not permit me to solve satisfactorily, whether the same beetles re-enter the ground and re-visit the tree day after day, or whether, on the contrary, they are short-lived, and, after their first nocturnal havoc, pair and re-enter the ground only to propagate. The appearance of fresh holes daily would indicate the latter alternative, and I am inclined to believe that the injury was done by a succession of beetles, and also by a succession of species, as it continued for the period of nearly a month, gradually diminishing, however, and being worst during the first few nights and especially in warm and calm weather.

Mr. Schwarz said that Lachnosternas were rarely observed in the daytime except in cities, where they cannot enter the ground, and that it was difficult to estimate their life-period, which however probably extends over several weeks.

He said, also, that in Europe the damage occasioned by the larvæ was important, while in this country the adult was most feared. He thought that good results could be obtained by planting low shrubs, which would attract the beetles and from which they could be collected nightly. He instanced in this connection the collecting of Mr. Smith and himself in the summer of 1888.

Mr. Fernow spoke of the allied beetle of Europe, *Melolontha vulgaris*, and said that similar methods of collecting were there employed. He said that ground had been flooded for five months without killing the larvæ.

Mr. Riley said that the idea put forth by Mr. Schwarz to the effect that these beetles swarm preferably upon the lower limbs of trees and upon small trees, and the conclusion then reached that these trees can be materially protected by beating the beetles must be abandoned in the light of his experience. The trees affected on his place were the tallest upon it, while none of the numerous smaller trees he had planted were in any way affected or attacked. Thus, besides a number of fruit trees, including Peach, Pear, Cherry and Apple, he had also the Sugar Maple, Norway Maple, Tulip, Gum, Linden, Willow, Poplar, Ash, Elm, Beech, and various shrubs and conifers, all accessible to the beetles, and from which they could have been easily beaten. He considered the experience of Schwarz and Smith in collecting from young oaks planted by the Park Commission to be exceptional, and instanced other cases of the beetles attacking particular trees—Poplars, Oaks, etc.—indicating the frequently local nature of their work. He said also that Europe, in methods of controlling these insects, was behind the times, mentioning in this connection the available means against the larvæ practiced here, but unknown or not practiced in Europe, such as the use of kerosene emulsions and fallow ploughing.

Mr. Howard referred to the experience of Messrs. Sc

and Smith, in 1888, when the beetles occurred abundantly on *young* trees, and could be easily collected, and stated that in the summer of 1887 they were abundant in the Department grounds, but occurred in numbers only on the largest trees and on the topmost branches, thus confirming Prof. Riley's experience.

Mr. Fernow, replying to Prof. Riley, said that in Europe they spread rapidly and "became *local* everywhere," so that all measures were ineffective on account of the enormous area to be covered and the consequent cost. The only way was to collect the imagines and burn them, the cost of which was met by the Government.

Prof. Riley admitted the impracticability of the various means under the circumstances mentioned by Mr. Fernow.

Mr. Mann thought that attracting to light would be effective at times, and referred also to the damage to grass lands in New England occasioned by the larvæ.

Mr. Schwarz thought that light, unless electric, would be of little value.

Mr. Schwarz presented the following paper:

NOTE ON THE FOOD-HABITS OF XYLEBORUS TACHYGRAPHUS AND X. DISPAR.

By E. A. Schwarz.

Last Sunday in May, while on an entomological excursion in the hills along the Virginia side of the Potomac, Mr. Theo. Pergande called my attention to some holes, evidently made by a Scolytid beetle, in young shoots of Liriodendron bushes. These bushes had greatly suffered from a fire which last fall had run through that part of the woods, but they were still green, and would, in all probability, have recovered but for the attacks of these Scolytids. Dead or nearly dry shoots, or those which were less than 18 mm. in diameter, were not attacked. The holes occurred singly, usually just beneath the origin of a small twig, in some instances also just above such places, and very rarely also remote from the base of a twig. In a shoot of six or more feet in height sometimes four or five holes were thus found, but often only two or a single one.

Upon investigation these holes proved to be made by two species of Scolytids, *Xyleborus tachygraphus* and *X. dispar*,

both often occurring in the same Liriodendron shoot, and their galleries are entirely undistinguishable. The galleries were in various stages of perfection, and in each only a single female beetle was found at work. The accompanying figure (kindly drawn for me by Dr. Geo. Marx) illustrates a complete, or nearly complete, gallery, from which a female specimen of *X. tachygraphus* was taken, and hardly needs any further explanation. It consists of a horizontal gallery nearly encircling the core of the shoot, and of one, or two, or more, vertical galleries of considerable length. The walls of the galleries are coated with a black, granular substance, apparently consisting of excrements permeated with exuding sap, and this is again covered in places with a whitish, glistening substance—the "ambrosia" of Schmidberger—which is supposed to be the food of the larvæ. Only in the vertical galleries eggs or young larvæ of the Scolytids were found at this season, their number in each gallery varying from two to six, but in many instances they were replaced by another and quite different Coleopterous larva which proved to be that of *Bactridium cavicolle*. Sometimes the vertical galleries were crowded with them, and wherever they occurred there was no trace left of the Scolytid eggs or larva. I presume, therefore, that this *Bactridium* larva devours or crushes the eggs or larvæ of this *Xyleborus;* but it is also possible that they crowd into the galleries before the parent *Xyleborus* has commenced ovipositing.*

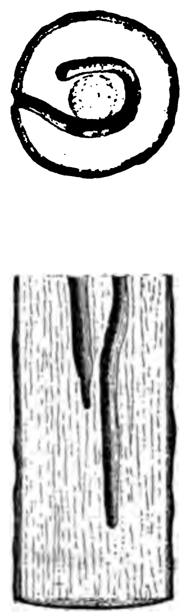

Fig. 3.-Work of *Xyleborus tachygraphus* in *Liriodendron tulipiferum*. Upper figure: transverse section; lower figure: longitudinal section. Natural size.

Xyleborus tachygraphus is one of our rarest Scolytids, and nothing was hitherto known of its food-plants and habits; but of hardly less interest is the occurrence of *X. dispar* (*pyri* Peck) in *Liriodendron tulipiferum*. In Europe, its native

*In the hope of obtaining the hitherto unknown male of *X. tachygraphus*, which is presumably of the same form as that of *X. dispar*, I carried home several infested shoots cut up in pieces of convenient length, but in the breeding-jars they at once commenced to mould and the Scolytid larvæ perished. Some specimens of *Bactridium cavicolle* were, however, bred.

home, this species is known to live in all sorts of deciduous trees, whereas in North America it has heretofore been found only in cultivated apple and pear trees. Its occurrence in tulip trees is, therefore, not only an interesting scientific fact but of considerable economic importance, because the only available remedy, viz: cutting off and burning the infested branches, naturally loses a great deal of efficacy in view of the fact that new beetles come from their wild food-plant or food-plants and restock our orchard trees. The only preventive of this new danger is a greater attention to clean forest culture on the part of the farmers, and more especially the discontinuance of the pernicious custom of burning the woods. If it is a deplorable fact that the various borers in orchard trees are by far more injurious in this country than their congeners are in Europe, the burning of the woods is one of the principal causes of this prevalence. The half-scorched trunks and branches of our forest trees and shrubs form the most perfect nidus for all sorts of borers, *e. g.*, *Chrysobothris femorata*, *Amphicerus bicaudatus*, *Saperda candida*, and a host of others. These insects thrive for one generation in the scorched wood, and since this, after the lapse of one year, becomes too dry for them, they have to oviposit in healthy trees, and naturally choose our cultivated orchard and garden trees, because these are more attractive to the beetles, more tender and less resistant than the healthy forest trees.

From the nature of the burrows of these two Scolytids it can at once be seen what amount of damage the beetles are capable of inflicting: the burrowing of a single specimen is necessarily fatal to a twig of considerable thickness. Of *Xyleborus tachygraphus* nothing further is known; but *X. dispar* is known to oviposit not only in branches, but also in the trunks of large trees. In this case the nature of the burrow is changed: the gallery does not encircle the core of the tree, but only enters the wood for a comparatively short distance, and branches out in perpendicular galleries. The vitality of the tree is then in no way affected unless the beetles are very numerous. This mode of attack has been described by Dr. Fitch in his third New York Report (pp. 327–328), and a good figure thereof is given by Eichhoff (Europ. Borkenkäfer, p. 271).

Prof. Riley discussed briefly the question of the food-habits of the larvæ of *Xyleborus* (which he said was being investigated by Miss Ormerod), and took issue with Mr. Schwarz in

the latter's view that cultivated trees were more susceptible to the attacks of insects than were wild trees, and also that insects bred in burned trees go of choice to cultivated ones. The idea that cultivated trees, when properly cared for, are more tender or more liable to attack, was very common but fallacious. As a rule they were more vigorous of growth, and, as a consequence, less subject to attack.

Mr. Fernow sustained Prof. Riley in this view, and, while agreeing with Mr. Schwarz in that the burning furnishes favorable conditions for the multiplication of the beetles, he held that cultivated forest trees were not especially liable to attack unless they had been previously weakened and injured from some other cause.

In reply, Mr. Schwarz called attention to the frequent forest fires and the consequent enormous multiplication of Scolytids, which did not result in the overrunning of unburned areas with these beetles. He said that in 1876, at Lake Superior, he had seen on a large tract of burned white-pine land perfect clouds of *Pityophthorus puberulus* and other Scolytids which had developed in the half-burned trees, yet the adjoining forest did not suffer subsequently. In the cultivated forests of Europe a single acre left in such neglected condition would bring destruction to a large extent of surrounding forest. According to Mr. Schwarz, the only explanation of this difference is that the wild forest trees possess a greater power of resistance to the attacks of Scolytids, which is partly or wholly lost in the cultivated trees of forest and orchard.

Mr. Ashmead related his experience with Scolytids in Florida orange groves, and agreed with Prof. Riley that cultivated trees were equal, if not superior, to wild trees in their power of resistance to insects. He mentioned a case of an orchard scorched by fire, in which a common Scolytid appeared the following year in great numbers, and stated that the work of these beetles always followed injury resulting from some other source.

Prof. Riley wished to be recorded as agreeing with Mr. Schwarz's conclusions, except as to the explanation of the effect on cultivated trees of the burning of forests, accom-

panied with the consequent increase of wood-boring insects. He strongly held that our cultivated trees are more vigorous in growth than their natural congeners in the natural forest, while the trees of North America, as a rule, grew more vigorously than those of Europe; and that the view that insects attack cultivated trees because these are more tender is entirely erroneous.

Mr. Howard read the following paper:

THE HABITS OF EURYTOMA.

By L. O. Howard.

From the close morphological relationship of *Eurytoma* with the only phytophagic chalcidid genus, *Isosoma*, it has been questioned as to whether the former genus might not be inquilinous, or at least contain inquilinous species. From the fact that *Eurytoma* is reared almost exclusively from the habitations of endophytic insects, the correctness or incorrectness of this surmise is difficult to ascertain; and while the general opinion is to the effect that *Eurytoma* is parasitic, still no conclusive observations concerning the gall-inhabiting forms are on record, so far as I know; and we must remember that general opinion has always, until very recently, considered *Isosoma* as a parasite, solely from a supposed necessary uniformity of habit in the family Chalcididæ, or the series *Parasitica*.

Eurytoma is reared commonly from hymenopterous (Cynipid and Tenthredinid) and dipterous (Cecidomyiid, Trypetid and Agromyzid) galls, as well as from the burrows in wood of beetles of the families Curculionidæ and Scolytidæ, and of wood-boring bees and wasps. But two exceptions to this general statement are known to me. Mayr reared *E. appendigaster* from a Microgaster cocoon, and Giraud reared *E. nodularis* from a burrowing wasp's nest, and noted that it was hyperparasitic upon *Cryptus bimaculatus*.

In order to absolutely prove the actual habits of the species so commonly reared from galls, it will be necessary to open a gall at the proper time, note what the larvæ are doing, and watch them to maturity, and thus determine that you have *Eurytoma* larvæ and not those of some other of the very numerous gall-inhabiting Chalcidids.

Somewhat by accident, and certainly by good fortune, I have just been able to accomplish this result: In August,

1889, I picked a handful of galls of *Cynips quercus-prunus* (determined for me by Dr. Riley) from the ground in Lovers' Lane, Georgetown, D. C., and placed them in a beaker on my office desk. May 17, 1890, I cut open one of the galls and found six apparently full-grown parasitic larvæ and the remains of a larva which they had nearly devoured. I was very doubtful as to my success in rearing these larvæ after they had been thus disturbed, but I put them away without covering the hole. May 31 I again examined them and found that all had transformed to white pupæ, which on June 1 had turned to the natural black color, and which were at once recognizable as those of a species of *Eurytoma*. June 2 another gall was cut open and similar larvæ were found not as yet transformed. No more conclusive proof will, I think, be needed as to the parasitism of this species, at least, of this genus.

Walsh reared from *C. quercus-prunus* his *Eurytoma prunicola*, and I find from Prof. Riley's notes that in February, 1879, he bred a species of *Eurytoma* from galls of *C. q.-prunus* collected by Mr. E. A. Schwarz at Hearne, Texas.

Examination of these latter specimens, which I found in the National Museum collection, shows that the Texas Eurytomas belong to a new species, which may or may not be the same as that found in the District of Columbia. Future rearing of the latter only can determine this point.*

Prof. Riley stated that the parasitic habit of *Eurytoma* had been practically proved in his experience long since, and that its being thus conclusively shown in this instance was interesting. The concensus of observation was so overwhelming that doubt was hardly justified; the larvæ of Chalcids are easily distinguished from those of Cynipids, and he had often had proof that was satisfactory to himself of the fact. He mentioned the much more justifiable doubt of some whether *Isosoma orchidearum* was truly phytophagic, and described having watched day after day the feeding of the *Isosoma* larva on the plant tissue.

Mr. Ashmead said that *Eurytoma* were frequently reared from Cecidomyiids and that the National Collection was rich in such rearings.

It was decided to dispense with the July and August meetings.

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*June 6, 1890. Two of specimens issued to-day, and proved to be *Eurytoma prunicola* Walsh.—L. O. H.

SEPTEMBER 4TH, 1890.

Nine persons present. President Marx in the chair.

A publication committee was appointed, consisting of the following members: Messrs. Howard, Schwarz, Marlatt and Mann; Mr. Marlatt, as secretary, to act as chairman. Mr. Mann gave notice of the desire of Rev. Dr. J. G. Morris, of Baltimore, to resign his active membership in the Society because of his inability to attend and participate in the meetings. His resignation was accepted.

Mr. Heidemann presented the following note:

NOTE ON THE OCCURRENCE OF A RARE CAPSID, NEAR WASHINGTON, D. C.

BY OTTO HEIDEMANN.

During the past summer I have been fortunate enough to discover in the vicinity of Washington quite a number of new or rare *Capsidæ*, of which *Cylapus tenuicornis* Say is by no means the least interesting species. The general appearance of this remarkable Capsid is admirably characterized in the original description of Thomas Say (LeConte edition, I, p. 377) in the following words: "Readily distinguishable by the tenuity of the antennæ and the very prominent eyes; the head also is almost vertical and the feet are long. In the magnitude and prominence of the eyes it resembles *Salda* and *Acanthia*."

As I am not aware that this species has ever been found again in any part of the United States (it proved to be new to Prof. Uhler's cabinet) since the days of Say, whose specimens came from Indiana, I think that a few words regarding its mode of occurrence will not be out of place.

In the earlier part of August Mr. Schwarz and myself, while on an excursion near Bladensburg, Md., in a very moist and shady part of the woods along the Eastern Branch, came across a small dead oak tree, which had been half-broken down by a storm a year or so ago. From the upper part of the tree two or three specimens of the *Cylapus* were beaten, but we discovered afterward that the part of the tree close to the ground was literally swarming with these insects. Their color perfectly harmonizes with that of the bark, and they can hardly be distinguished as long as they are quiet. When disturbed they run with the greatest agility along the bark and take

wing rapidly. The best way of capturing them was to place our umbrellas on the ground close to the tree and to jar the latter with a heavy stick. Some forty or fifty specimens were thus brought down on the umbrella, and, though most specimens escaped, I secured a good series of both sexes. The males are at once distinguishable from their smaller size and more

FIG. 4.—*Cylapus tenuicornis* Say (original).

elongate form, aside from the differences in the last abdominal segment. Larvæ and pupæ occurred in company of the imagos, but no eggs could be found in spite of diligent research. The bark of the tree was covered with lichens, moss and small fungi, from which the insect probably derives its nourishment. The species continued to be abundant on the same tree up to the last week of August, when they gradually became scarcer.

Mr. Schwarz exhibited specimens of *Choragus nitens* found on the small dead white oak on which Mr. Heidemann's Capsid occurred, and remarked that this species had hitherto been found but once, viz: at Lowell, Mass., by Mr. Blanchard, and is therefore an interesting addition to the fauna of the District. It breeds in the soft wood directly beneath the bark, and possesses considerable leaping power. The same oak tree yielded a specimen of an undescribed genus allied to *Xenorchestes*.

In response to a question by Prof. Riley regarding the leaping Rhynchophora, Mr. Schwarz said that the genus *Orchestes*,

and all genera of the tribes *Aræocerini* and *Xenorchestini*, possess jumping power. The smaller species of *Cæliodes* can also leap very well, and this power is possessed by other Coleopterous families, including some species of *Olibrus*, of the family Phalacridæ, of which the possession of this power is apparently not recorded. He said also that with many jumping beetles the hind legs were not thickened.

Mr. Howard said that the Chalcidids that jump best do not have thickened femora, but possess large apical tibial spines on their middle legs. Prof. Riley referred also to the jumping power of Psyllidæ, which did not depend on incrassated femora.

Mr. Schwarz further exhibited a specimen of *Hymenarcis nervosa* with abnormal antennæ. The right antenna was normal, while the left had but four instead of five joints, the second and third being much thicker and shorter than the corresponding joints in the right antenna, and the terminal joint being very short and clavate.

Mr. Schwarz also exhibited a branch of *Carpinus americanus*, one side of which was healthy and the other dead, and thickly infested with a Curculionid, *Acoptus suturalis*. It was supposed that the eggs were deposited in living wood by the parent beetle, and that this species is therefore injurious.

Mr. Schwarz called attention also to a paper by Dr. A. Vœltzkow on the fauna of Vituland (East Coast of Africa), published in *Das Ausland*, 1880, No. 28, pp. 441–445, in which the statement is made that certain small Gryllotalpas captured were always stylopized. Mr. Schwarz said that there was no reason for doubting the correctness of this statement, which added a new order of insects to those (Hymenoptera and Homoptera) known to be infested by Stylopidæ.

Dr. Marx described having recently found a number of specimens of *Lathrodectus* under a board devouring Carabids, of which fragments garnished the web of the spiders.

As possibly throwing light on the subject, Prof. Riley mentioned having been greatly surprised this summer at the large number of insects, *Xylocopa*, *Bombus*, *Lachnosterna*, *Anthrax* and Lepidoptera, particularly Sphingids, that he had found

about his grounds at Sunbury, with large perforations and apparently killed by birds, and probably by the house wren. In one instance a species of Attus was observed feeding on the remnants of one of these gutted insects, and he suggested that the beetles observed by Dr. Marx may, in part at least, have been killed by birds.

Dr. Fox thought that the birds would snap off the wings and head of the insects mentioned and swallow the balance entire, and believed that the holes had probably been eaten out by spiders.

Prof. Riley described his recent investigations of the life-history and habits of *Sphecius speciosus*, exhibiting specimens of the egg *in situ* on Cicadas, and of the young and full-grown larvæ and cocoons.

Careful drawings were also shown illustrating the different stages and habits of the insect.

He stated that *Sphecius* was always rather common in the District, but this year was particularly abundant in the Department grounds from the last week of July into August. Advantage was taken of this to endeavor to work out the full life-history of this insect. This had been traced from the egg to the cocoon. The transformation to the pupal state would not take place till later, probably not much in advance of the appearance of the adults next year. An interesting point mentioned was the rapidity of the development of the larva. This had not been fully followed, but the larval period was judged not to exceed a week. It was stated also that *Sphecius* undoubtedly requires dry ground in which to undergo the transformations. Excessive moisture induces mould in the Cicadas, and many specimens unearthed were destroyed by this agent; and Cicadas in burrows in dryer earth were found one year old, and apparently perfect.

Prof. Riley described the habit of the *Sphecius* larva in constructing its cocoon, which is silken, with enough earth incorporated to make a dense pod.

The egg was described, and also the frequently many-branched burrows excavated by the adult insect.

In the same connection, Prof. Riley presented to the Society a female *Megilla maculata* which he had found recently devouring the egg-masses of *Hyphantria*, and which subsequently laid a batch of eggs. Neither the eggs nor the larvæ of this very common ladybird have hitherto been described or recorded, and he will take occasion to refer to them more fully at some future meeting.

Relating to the notes on *Sphecius*, Mr. Schwarz said that in the literature this insect is always treated as an enemy of the Periodical Cicada, and asked if *Sphecius* had ever been observed to attack *C. septendecim*. He said that the Periodical Cicada always appears several weeks earlier than *C. pruinosa* or any other Cicada, and that *Sphecius* appears in conjunction with *C. pruinosa*, from which it was unlikely that this wasp has an opportunity of preying upon *Cicada septendecim*.

Prof. Riley showed that the periods of *Sphecius* and *C. septendecim*, and also the common Dogday Cicada, overlapped, and that the general belief that *S. speciosus* attacks the Periodical Cicada, while not based, as far as he recalled, on observation, was probably well founded.

He said that in 1885, when the *C. septendecim* was abundant, he had been interested in the comparison of the notes of the two species. He believed also that *Sphecius* often occurs in June or before *C. pruinosa*, though he had never seen it using any other species than this last. So far as there might arise a question based on the smaller size of the Periodical Cicada, Prof. Riley said that in the case of *Sphecius* and other parasites the larva adapted itself, to a great extent, to the amount of food supplied by its host.

Mr. Howard exhibited specimens of the Sand Cricket, *Stenopelmatus fasciatus*, which had recently been sent to Prof. Riley by one of his correspondents. Mr. Howard stated that they occurred abundantly in the southwest, and were reported erroneously to be extremely poisonous. He quoted Prof. Riley, in the *Standard Natural History*, to the effect that they are carnivorous in habit.

Mr. Schwarz stated that these crickets are very common under stones in the west, occurring in company with a

species of *Galeodes* of similar appearance, and perhaps poisonous, which would account for the fear of the natives.

Mr. B. P. Mann stated that he had decapitated some living *Caloptenus femur-rubrum* to utilize the remains as food for tortoises, and that he had observed that while the bodies were upon the ground in natural posture they exhibited apparently normal powers of saltitation. Some ants having seized the tarsi of the decapitated locusts, the latter sprang away with vigor and alighted upon their feet again. The experiment was repeated several times with the same and with different individuals. When the locusts were confined so that they could not jump, they kicked vigorously and flung the ants away from them. Locusts confined but not mutilated did likewise for a time, but after awhile yielded to the ants, and allowed themselves to be bitten without resistance.

Mr. Schwarz read the following paper:

COLEOPTERA ON BLACK LOCUST (Robinia pseudacacia).

By E. A. Schwarz.

Early in May, Mr. H. Ulke found a rare and interesting Cucujid beetle, *Ino reclusa*, on dead branches and trunks of black locust trees, and as I was desirous of finding this species myself, I made during May and June a rather careful investigation of a few small trees which had recently died from the combined influence of fire and insect attacks. A few of the most promising pieces of the trunks and larger branches were carried home by me, and an astonishing number of specimens bred from them. The following list includes the species that have been bred up to the middle of June, as well as those which were cut from the trees in the field. All come from a small locality in the vicinity of Washington known among the resident entomologists under the name of "red-bug meadow," and where, besides the Acarid which furnished the name, a host of rare insects of all orders can be found throughout the whole year.

Oligota n. sp., common.
? *Leptusa* sp., not rare.
Sacium lunatum, common.
Læmophlœus adustus, common.
Sinoxylon dinoderoides, two specimens.
Cyrtinus pygmæus, several specimens.

Læmophlœus modestus, several specimens.
Ino reclusa, common.
Lathropus vernalis, not rare.
Soronia undulata, several specimens.
Amphicrossus ciliatus, one specimen.
Trogosita corticalis, not rare.
Agrilus egenus, common.
Petalium bistriatum, common.
Leptostylus commixtus, common.
Liopus fascicularis, two specimens.
Ecyrus dasycerus, common.
Mycetochares haldemani, one specimen.
Zaglyptus striatus, common.
Plocamus hispidulus, not rare.
Hypothenemus eruditus, common.
Micracis rudis, one specimen.
Eusphyrus walshii, not rare.*

Any one who is in the least acquainted with the food-habits of Coleoptera will at once see that the above list contains very few species which may be peculiar to the Black Locust. The *Staphylinidæ* and the *Trogosita* are probably predaceous; all of the *Cerambycidæ* and some of the other species are known to live in other trees; some other species are sap-beetles, not particular in the choice of trees, and there remain only the following, to be briefly commented upon: *Sinoxylon dinoderoides*—there is no previous record of food-habits, but judging from the polyphagous habits of allied species it is not likely that it will prove to be confined to Black Locust. *Ino reclusa*, previously known only from Texas, where it occurred on Hackberry. *Zaglyptus striatus* breeds in great numbers in the outer layers of nearly dead wood and is possibly peculiar to this tree. *Plocamus hispidulus* is known to me only from Black Locust, but is also not an injurious species since it lives like the preceding. *Micracis rudis*—I failed to discover the gallery of this, and from the single specimen obtained it would be premature to draw conclusions as to food-habits. It has previously been recorded as boring under bark of Hackberry. *Agrilus egenus* has frequently been bred before from branches of Black Locust, and is the only species on my list which may be injurious to the tree.

The Black Locust is very abundant in the vicinity of Washington but almost exclusively in the form of bushes or small trees, while larger trees are very scarce except in protected places, and still scarcer are healthy large trees. It is evident that the growth of the tree must have one or several serious checks, and while the frequent fires no doubt largely contribute to prevent a healthy growth of the tree I have become

*Two species of Elaterid larvæ, a Buprestid larva (*Chrysobothris ?*), a Melandryid (?) larva and several Cerambycid larvæ dried up, and were not bred.

convinced that the principal cause of this failure is the work of a single insect, the Lepidopterous gall-maker—*Ecdytolopha insitiana*. Dr. T. W. Harris gives a good account of what he found as the most destructive enemy of the tree, viz., the well-known *Cyllene robiniæ*, and attributes to it the complete disappearance of the tree in some of the Western States. He is no doubt correct in this opinion for the localities referred to by him, but in the vicinity of Washington this Cerambycid yields the first rank to the *Ecdytolopha*. This is an extremely abundant species, and it is only to be wondered that its destructiveness to the Black Locust did not attract the attention of Harris or the other older authors. It oviposits in vigorous young shoots, which usually die soon after the moth has issued from the gall, or which at best remain sickly and never grow up to a large tree. The wound rarely heals over; on the contrary, it is usually enlarged by the action of numerous sap-beetles or other insects which invade the deserted gall.

Cyllene robiniæ comes next in importance as an enemy of this tree. Although a very common insect near Washington, it is not so universally distributed as the gall-moth and seems to live in large colonies, affecting all trees of small groves, while long hillsides full of locust trees are not infested by it. There are always numerous larvæ in a single trunk, and a tree once infested is usually occupied by two or three successive generations of larvæ until it dies. *Xyleutes robiniæ* would be equally destructive but is much rarer here, and apparently prefers other trees. Whether or not *Agrilus egenus* is to be classed among the important enemies of the Black Locust must be left undecided, but it certainly prefers to breed under the bark of branches of small trunks which have already greatly suffered from various other causes.

The host of insects feeding on the leaves may be divided in two classes. Those which feed externally on the leaves (numerous Lepidoptera, various *Tenthredinidæ* and Coleoptera) do not seriously injure the tree. Total defoliation by them hardly ever takes place, and the damage caused by all of them combined is certainly much smaller than that done by the second class, the leaf-mining species (various *Tineidæ* and *Odontota dorsalis*). These produce almost every year that burnt appearance of the locust trees so noticeable in July or later in the season, and the premature loss of all or most leaves naturally weakens the trees. The Elm trees in our parks, when defoliated by the second generation of *Galeruca xanthomelæna*, produce a new growth of leaves and are green in the autumn; but the Black Locust, if once defoliated, remains so for the rest of the season. These leaf-mining sp

and more especially *Odontota dorsalis*, were exceptionally rare this season, and no appreciable damage was done by them.

There is some confusion in the statements of various authors regarding the species of *Apion*, which breeds in the seeds or feeds on the leaves of the Black Locust. Say states that Dr. Melsheimer found *Apion rostrum* on the leaves; Dr. Harris says that *A. rostrum* breeds in the seeds of *Baptisia tinctoria*, and that "a smaller kind somewhat like it inhabits the pods and eats the seed of the locust tree;" Dr. Fitch, in his 5th Report, enumerates *A. rostrum* among the locust tree insects, and remarks that the species is very variable in size and sculpture, that it eats holes in the leaves, and that it probably breeds in the seeds; Dr. LeConte, in the "Rhynchophora," simply says that the species from Black Locust is different from *A. rostrum;* Dr. Packard, in his Bulletin on Forestry Insects, has again *A. rostrum* among the Black Locust insects, and generally follows Fitch's account. I have myself never found *A. rostrum* on the Black Locust, but the species so commonly found feeding on the leaves of this tree is undoubtedly *A. nigrum* Herbst (as redescribed by Prof. J. B. Smith), and I feel confident that this is the same species which is said by Harris to breed in the seeds of the tree. At any rate, *A. rostrum* should no longer be included among the Black Locust insects.

Spermophagus robiniæ should be omitted from the list of Black Locust insects, since it cannot possibly live in the seeds of the tree, for the reason that the larva is at least five times larger than the seed. Its only food-plant is the Honey Locust (*Gleditschia triacanthus*), the seed of which corresponds in size with that of the larva.

Mr. Howard stated that so far from there being no large locust trees in the vicinity of Washington, they were very abundant in old yards in Maryland near Washington, where this tree seemed to have been a favorite. Of leaf-miners, he mentioned *Gelechia pseudacaciella* Chamb. as of chief importance, the leaves frequently being whitened by the work of their larvæ. He had particularly noted this appearance in the case of young trees bordering fences during a recent drive of a few miles into the country.

Prof. Riley stated that approaching and up to Hagerstown, Md., the trees were seared by *Odontota dorsalis*. He agreed in general with Mr. Schwarz as to the cause of the failure of the

locust to attain considerable size, but that the increase of the locust-borer, *Cyllene robiniæ*, was largely the cause of this.

He said, further, that the nature of the soil had much to do with the successful growth of the tree, instancing in this connection that at Davenport, Iowa, and other localities that he was aware of, on high and dry land with a limestone subsoil, it became a large tree, but in low, moist ground it was seriously attacked.

Mr. Schwarz stated, in reply to Mr. Howard, that his paper had been prepared two months previously, and he admitted that the various leaf-miners, and particularly those mentioned by Messrs. Riley and Howard, had greatly increased outside of the District. He stated also that in Europe the tree was a magnificent one.

Mr. Howard stated that the freedom of the locust trees in the grounds of the Department from leaf-miners was doubtless owing to the fact that the leaves were regularly raked up and disposed of in the fall.

Prof. Riley called attention to the curious fact that in the case of the Locust and Hickory Cyllene the larva of one was footless and the other was provided with feet, and that this marked structural difference in such closely allied species also occurred in the case of the genus *Prodoxus* and *Pronuba*, and forcibly illustrated the folly of attaching too great classificatory value to larval characters.

Mr. Schwarz exhibited the burrows of some Scolytid beetles, and explained them by the following remarks:

NOTES ON THE BREEDING HABITS OF SOME SCOLYTIDS.

By E. A. Schwarz.

Xyloterus politus.—This is an abundant, and, at the same time, very destructive species, yet very little seems to be published of its food-habits. Mr. J. W. Randall, who described it as *Tomicus gularis*, found it "about the sap of newly-cut maple trees in April," and Dr. J. A. Lintner found it "depredating upon maple trees." Some years ago it attacked and killed, within less than two years, two beautiful trees of silver birch (*Betula alba*) in the grounds of Mr. Bela

Hubbard, at Detroit, Mich., the only other injurious insect associated with it being *Agrilus torpidus*. The present year *X. politus* infests, in large numbers, large trees of *Negundo aceroides* and *Fraxinus sambucifolia* growing along the Potomac near Washington, and which had been partially decorticated or dislocated by the great freshet of June 2, 1889. Many of the trees show already unmistakable signs of decay. Last August I found at Bladensburg, Md., a moderate-sized soft maple tree which had been thrown down by the wind, and in which the beetles were at work. I made a cross section through one of the burrows, and it can be seen therefrom that there is a slightly undulating main gallery leading horizontally into the wood for a distance of about 70 mm. A longitudinal section through this gallery shows that at about its middle, and both above and below, it is intersected by a number (5 in the specimen exhibited, but the number no doubt variable) of rather closely placed perpendicular galleries (larval cradles), averaging each about 15 mm. in length. They are of the same width throughout as the main gallery, thus showing that they have also been excavated by the parent beetle. The whole work resembles that of *Monarthrum mali*, but in *Xyloterus* the perpendicular galleries are a little longer. The walls of all galleries are stained with black, and this serves to distinguish the work of *Xyloterus* from that of a Ptinid beetle, *Ptilinus ruficornis*, which was boring in the same maple tree, and which excavates a simple gallery also leading deep into the wood, but without any branches, and its walls never stained black.

XYLEBORUS FUSCATUS AND X. PUBESCENS.—A very large colony of these Scolytids was found by Mr. Ulke and myself in the mountains at Pen-Mar, Pa., on August 2, infesting a stump of a large butternut tree (*Juglans cinerea*) which had been felled at least one year before.* Both species are true wood-borers, and I am unable to distinguish their galleries, which occurred promiscuously in the stump. Owing to the want of proper instruments, and on account of the hardness of the wood, only fragmentary portions of the galleries could be secured. The work of the beetles consists of a long horizontal gallery leading straight, or slightly obliquely, or slightly undulating, into the wood for a distance of at least 60 mm. Branching off at nearly right angles to the right or left, and at intervals of about 15 mm., are several (two or three, and perhaps more, on each side) lateral horizontal gal-

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*The stump was at first taken by me as that of a walnut, but I am informed by our best authority, Mr. B. E. Fernow, that it is a butternut.

leries in which the larvæ develop. One of these branch galleries measured 12, and a second more than 20 mm. in length. At several points within the main and lateral galleries are short (from 5 to 8 mm. in length) vertical galleries, made by the beetles to reach a lower level from which to construct another story of horizontal galleries. The largest piece of wood cut from the stump shows three stories of galleries, and I presume that in this instance several specimens of female beetles participated in the work of excavation. The work of these two *Xyleborus* closely resembles that of the European *X. dryographus*, as described and figured by Eichhoff. Large numbers of *Hypophlœus thoracicus* were found among the *Xyleborus*, and no doubt depredate upon their larvæ.

I may add that in the same stump a single male specimen of the rare *Xyleborus planicollis* was found (unfortunately not recognized at the time of collecting), and that Mr. Ulke found therein a colony of *Dryocœtes granicollis*, but no notes were taken of its mode of work.

CNESINUS STRIGICOLLIS.—This is a widely distributed (occurring from Michigan to Florida and Texas) though not very abundant species, and probably not of economic importance. Of its food-habits I find nothing recorded excepting a short note by Dr. Hamilton (Can. Ent., 19, 1887, p. 66), stating that the species "occurs here [Allegheny, Pa.] on Osage Orange, which it probably followed from the south." At Columbus, Texas, it occurred exclusively on the "Gum Elastic tree" (*Bumelia lanuginosa*), while near Washington I found it last July and August on a felled Black Gum (*Liquidambar styraciflua*). As often as I passed the tree I beat quite a number of specimens from it so that I felt confident to find the burrows of the Scolytid in the tree. I went to work tearing off the bark, but since the tree was quite large and the bark most tenaciously adhering I made but little progress. Finally, I noticed from a small hole in a branch about 30 mm. thick some sawdust dropping and ascertained that this was pushed out by a Scolytid, which proved to be a female of *Cnesinus*. A cross section through the branch revealed a gallery which, after piercing the bark, entered the wood for a distance of nearly 6 mm., and then abruptly bending followed an undulating course parallel to the bark, the whole length of the gallery being 17 mm. and its terminal point 5 mm. from the outer surface. There was no trace of secondary or branching galleries, nor of eggs or larvæ. That this burrow had been excavated by the *Cnesinus* there can be no doubt, but it is either incomplete or made by the beetle only for the purpose of feeding on the wood. I am inclined to believe the

latter alternative, since by far the greater majority of the tribe *Hylesini* are known to be bark-borers. At any rate I feel confident that *Liquidambar styraciflua* will prove to be one of the food-plants of this species.

OCTOBER 2ND, 1890.

Thirteen persons present. President Marx in the chair.

Messrs. J. M. Stedman, Nathan Banks and F. W. Mally were elected members.

Dr. Fox exhibited a specimen of a small spider belonging to the genus *Episinus*, which Dr. Marx stated was undescribed.

Dr. Marx called attention to two spiders new to our fauna—one belonging to the European genus *Histopona*, taken at Pen-Mar, Pa., and also received from southern Florida, and the other a new genus of uncertain position, but possibly allied to the *Agalenidæ*, represented by a single specimen, taken on the grounds of the Department of Agriculture.

Mr. Marlatt exhibited a specimen of *Trypeta æqualis* Lw., which he had bred from the seed pods of *Xanthium*, and the larval habit of which he had described at a previous meeting of the Society.*

Mr. Marlatt read the following paper:

OBSERVATIONS ON THE HABITS OF VESPAS.

BY C. L. MARLATT.

While residing in the suburban village of Takoma, Md., during August and September last, my attention was forcibly drawn to the enormous abundance of certain of the smaller Vespas, notably *Vespa germanica* Fabr. and *Vespa cuneata* Fabr. The former of these wasps greatly predominated, and was to be seen in numbers on every tree or bush and in the neighborhood of houses, where it was attracted by moisture about wells or to refuse fruit or melon rinds, etc.

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* See pp. 40–43.

People on porches were not infrequently stung by them, and constant precautions had to be taken to prevent their gaining access to dining-rooms. In houses of the poorer sort unprovided with screens, these wasps, on account of their numbers and pugnacious disposition, rendered the meal-taking a proceeding of positive danger.

In the woods they were observed running over foliage, which they appeared to examine carefully, doubtless in search of larvæ and spiders. None were observed to seize insects of any sort, however, and they were further repeatedly seen to pass with utter indifference colonies of aphids.

I discovered a number of the nests of these insects myself, and was directed to a considerable number by woodmen and others. All of these belonged to *V. germanica* with the exception of one underground nest of *V. cuneata*, found late in the season.

The nests of *V. germanica* may be classified as (1) above ground; (2) in or beneath stumps or stones; and (3) in excavations in open ground. The latter form greatly predominated. Contrary to the habits of closely-related European species the yellow-jackets of this country build almost exclusively in the ground and rarely, if ever, attach their nests to trees or stumps. One of the nests brought to my attention was said to have been originally attached to a stump a few inches above the ground, but had been disturbed and broken up and a new nest had been formed in the base of the stump. A number of nests were found beneath stones and stumps, but no preference seemed to be shown for such protected situations as the majority were, as stated, in open ground.

These nests consisted of spherical excavations of a capacity of from one peck to half a bushel or more, and reached within an inch or two of the surface of the ground. Access to the nest is gained by a single (rarely two) circular or oval opening about ¾ inch in diameter, which, in open-ground nests, leads directly from the centre of the nest. The nest itself is too well known to require minute description. Briefly, it consists of a loose outer papery covering, which must furnish very slight protection, and does not compare at all with the tough, firm outer covering of the tree-nests of the larger Vespas, as that of *V. maculata*. Within this are four to eight horizontal stories or tiers of combs attached to each other by strong supports. In the larger nests opened these combs had a maximum diameter of twelve inches, and there were as many as eight tiers.

The life-cycle, also well known, is briefly as follows: The fully developed females and the males are produced

cells of large size, chiefly in the lowest or last constructed of the combs, during the month of September. Pairing takes place, and the females winter over and originate new colonies the following spring. Workers only are produced during the summer, or until the perfect females and the males of the succeeding Fall are developed.

No honey, wax or pollen is stored in their nests, but the young are fed by the workers on a liquid derived from larvæ or other substances eaten. These insects are not honey-gatherers and are not attracted particularly by flowers, but seem to be especially fond of the sweets of fruits and melons.

No evidence of the presence of parasitic insects was noted in the nests examined, and I believe no parasites of these wasps have been recorded in this country. A number of insects were found associated with the Vespas, none of which, however, can be considered inquilinous. They comprised a number of Dipterous larvæ occurring in the mass of debris about the exterior of the nest in the decaying musty matter which they breed; also, a number of partly-grown roaches and some Elaterid larvæ and beetles—the presence of which latter was probably accidental. Two species of Asilid flies, *Mallophora orcina* Wied. and *Deromyia discolor* Lw., were observed to prey on the Vespas in open places in woods. The interesting fact that these flies, to prevent their being stung, always seize and hold the Vespas while feeding on them with the abdomen of the latter pointing forward is mentioned in the *American Entomologist*, Vol. I, p. 140.

In addition to these insect enemies, I was informed by woodmen that foxes and skunks frequently dig out the ground-nests and feed on the larvæ and pupæ contained in the combs.

The nuisance of these insects about houses and the danger to teams, arising from the frequent proximity of the nest to roads, makes man their principal enemy. The method commonly followed to break up the nests is to build a fire of brush, etc., over them after all the Vespas have come in for the night. This plan I saw repeatedly tried, but subsequent examination showed that in every case it had been only partly successful—the upper tier of combs only being affected. In my own investigation a few spoonfuls of chloroform were introduced into the opening of the nest in the evening after all the hornets had come in, and in a few minutes the nest could be opened and examined with entire safety. A better method of destroying the nests than burning would be to introduce into them bisulphide of carbon, which would be cheaper than chloroform and equally effective. Either of these substances could also generally be applied in the case of

nests protected beneath stones or stumps, where burning would be out of the question.

In the course of my examinations of the nests I was stung in the hand by *germanica* several times—the resulting pain being very slight and of short duration. I was unfortunate enough also to be stung in the ear by *cuneata*, and the resulting pain was not only extremely severe but lasted for twelve to fourteen hours in spite of all attempts to allay it. The severity of the sting in the latter instance was in part, and perhaps altogether, due to the greater sensitiveness of the locality stung, but I cannot but believe that the sting of *cuneata*, which is the larger insect, is under the same circumstance more severe than that of *germanica*.

Mr. Howard stated that the locality of the sting had much to do with its severity, and he doubted if much difference would be found in the pain resulting from the sting of either species, if in the same place, on the subject.

Mr. Schwarz said that in Europe foxes were known to feed on the ground-nests of Vespas, readily eating the comb for the contained larvæ and pupæ.

Mr. Howard called attention to some interesting observations on the power of sight in *Vespa* by Mr. Scudder, which seem to indicate that these wasps see but poorly. This defective sight was shown in that they were frequently observed to attack the shadow of flies rather than the flies themselves.

Referring to the absence of parasitic or inquilinous insects in the nests examined by Mr. Marlatt, Mr. Schwarz said that this was remarkable in view of the number of insects associated with *Vespa* in Europe. He mentioned particularly an interesting parasitic Coleopter (*Metœcus paradoxus*) quite common in the nests of *Vespa* in Europe, and wondered that no similar parasite had been discovered in this country.

Dr. Fox asked if the sting of *Vespa* was barbed as with the honey bee, and Mr. Marlatt replied that the sting was but slightly barbed, and ordinarily remained with the insect instead of tearing out and holding in the flesh.

Mr. Dodge related his experience with a species of yellow-jacket in Colorado, and called attention to the rapidity of the

wasps to give the alarm following any disturbance at the mouth of the nest. He described the habit of the insects, when alarmed or disturbed, of clustering in dense masses or rows at the mouth or opening leading to the nest ready to attack the culprit *en masse*.

Mr. Stedman asked if benzine would not serve very well to destroy the nests and wasps.

Mr. Howard said that he had used kerosene very successfully for this purpose.

Mr. Howard then read a paper of which he has furnished the following abstract :

A NEW REMARKABLE GENUS OF ENCYRTINÆ.

By L. O. Howard.

The only Encyrtid with ramose antennæ ever found prior to last year, was the single male specimen found in 1837, in Coombe Woods, England, upon which Westwood founded his genus *Tetracnemus*.

Mr. Ashmead announced to this Society, February 7, 1890, that he had found in Florida a male Encyrtid which corresponded exactly to Westwood's description of *Tetracnemus diversicornis*.

I exhibit herewith a second genus of Encyrtinæ which shows this antennal peculiarity, so that *Tetracnemus* no longer remains the striking abnormality which it has hitherto been considered.

This new form of which we are also extremely fortunate to possess the female sex, while bearing a strong superficial resemblance to *Tetracnemus*, differs from it and from all other genera of the subfamily to which it plainly belongs by the possession of two ring joints to the antennæ, by the proportions of the antennal joints, by the fact that the ocelli are placed in a straight line across the top of the head, by the fact that the whole surface of the female abdomen is densely punctate, by the fact that the ovipositor is directed dorsally at right angles to the plane of the abdomen, and by the fact that the stigmal vein is long, straight, and descends almost vertically into the disc of the wing. From this last character I have called the new genus *Tanaostigma*, and have drawn up full descriptions of both sexes, which it will be unnecessary to read at this time.* The species I have named *T. coursetiæ*. It

*Published in full in *Insect Life*, Vol. III, No. 4, pp. 145–148, Nov. 1890.

was found in quite large series in the ovaries of *Coursetia* (?) *mexicana*, a rare leguminous plant collected in the Alamos Mountains, Mexico, by Dr. Edward Palmer.

Dr. Marx then read a paper of which he has furnished the following abstract:

ON THE EFFECT OF THE POISON OF LATHRODECTUS MACTANS WALCK. UPON WARM-BLOODED ANIMALS.

By Geo. Marx, M. D.

In the early part of last October I came accidentally in possession of quite a number of living specimens of this spider, so notorious on account of its supposed poisonous properties, and I concluded to make some experiments as to the effect of its poison on warm-blooded animals, in order to settle definitely, if possible, the question whether the bite of this spider may be fatal to man. This question, which some time ago had agitated scientists of many countries, was raised again by the recent publication of a case of alleged poisoning of a man in North Carolina with fatal results within less than twelve hours.*

As objects for the experiments of inoculations of the virus the following animals were selected: a rabbit, four Guinea pigs and a mouse, all healthy and well fed, which were kindly furnished by the Bureau of Animal Industry of the Department of Agriculture. The spiders, nearly all mature females, were fed copiously with flies and some Carabid beetles, which were devoured with great relish.

In dissecting the spiders the mandibular (poison) glands were found to be extremely small in comparison to those of other spiders. The walls of these glands being composed of both muscular (striated) and fibrinous bundles, are so thick that only a very narrow channel is left as a receptacle for the poison, and which would hold only about 7–1000th part of one cubic millimeter. As the spider possesses two such glands, which both are used always in biting, the quantity of poison which might be introduced into the body of the victim by the bite would therefore not be more than 14–1000, or about 1–75th of a cubic m.m., equal in bulk to the 1–5000th part of a drop of distilled water.

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*See Insect Life, I, pp. 204–211 (1888).

The first experiment consisted in the inoculation of a pair of unbroken poison glands into the region of the groin of the rabbit. An incision was made through the previously shaved off epidermis and the underlying adipose tissue to the muscles; then the poison bags were introduced and left intact for absorbtion. The result was negative; the rabbit continued to eat its food in ten minutes after the operation, and lived for over two weeks in perfect health, when it was used by one of the scientists of the Bureau of Animal Industry for other experiments, during which it died. The post-mortem examination of the infected part showed a hardly noticeable external scar, while the location of the deposition of the poison bags showed a slightly reddened area.

The next experiments were made with three Guinea pigs. Here the poison bags were introduced in the wound, made in the same region of the body as in the rabbit; they were then carefully opened and the contents squeezed out. In the third Guinea pig four glands were thus used. The result was the same as with the rabbit: the animals did not seem to be at all disturbed by the operation and lived for weeks—until they were disposed of in the same manner as the rabbit.

The fourth experiment was made with the mouse: the poison glands—the largest ones of all—were here also carefully opened in the wound. Result, the same as in the previous cases; the mouse seemed to enjoy particularly good health after the operation.

In the last trial another method was used for introducing the virus into the system of the Guinea pig. A full-grown female spider, which had been well supplied with flies and beetles for a couple of days before the experiment was made, was held by a pair of forceps at one of its posterior legs and was thus approached to the nose of the victim, which it immediately seized and wounded. After removing the spider from this place two small punctures could be distinctly noticed, as a little blood oozed out, which proved that the mandibular fangs had penetrated the epidermis. This operation was repeated once more, with the same result. The little victim was at first very much frightened and sat for awhile with head bent low down, its *panniculus carnosus* shivering violently. In an hour, however, it was quiet again and took food. It lived for three weeks in good health, when it had to follow the fate of its comrades.

These experiments, in which Dr. Moore, of the Bureau of Animal Industry, kindly assisted, showed conclusively that the poison of *Lathrodectus mactans* is not sufficiently strong to harm a small animal.

Mr. Schwarz said that Mr. H. Lucas had already performed this experiment on himself repeatedly without experiencing any effect.

Dr. Marx called attention to the fact that the opening leading from the chelicera to the poison sac is extremely minute, which, in connection with the small size of the latter, would indicate that a very small quantity of poison only could be injected into the wound made by the spider.

Dr. Fox inquired how long the spiders experimented with had been kept in confinement.

Dr. Marx replied three to four weeks, during which time they had been fed on flies.

Mr. Howard said that the first experiment was unsatisfactory and inconclusive. In the introduction of the poison sacs entire, it was very uncertain whether the poison was liberated before it had itself lost its toxic quality, if in fact, as Dr. Marx himself stated, it was not thrown out with the pus arising from the wound.

Dr. Marx promised to continue his experiments.

Discussion followed on the possibility of this spider, with its comparatively small jaws, piercing the skin of man, the conclusion arrived at being that in the usually exposed parts of the body this would be well nigh out of the question.

Mr. Ulke gave an interesting account of the habits of *Tachys incurvus* Say, which he had found in large numbers at Pen-Mar, Pa., in the nests of *Formica exsectoides*, and which is the first North American Carabid known as truly myrmecophilous. He also spoke of the habits of a myrmecophilous Staphylinid observed at the same locality. A large underground colony of an undetermined species of *Formica* was accidentally disturbed, and among the multitude of ants rushing forth from the entrance hole there were numerous specimens of this Staphylinid, which rapidly took wing and escaped. Only two specimens could be secured, which proved to be an undescribed species allied to *Myrmedonia*, and not mentioned by Schwarz in his list of myrmecophilous Coleoptera.

Mr. Schwarz said that *Tachys incurvus* was first found among *Formica exsectoides* by Mr. Blanchard at Lowell, Mass., and afterward among the same ant by Mr. Beutenmüller, near New York. The occurrence of the beetle in large number among ants at three different localities leaves no doubt that it is a true myrmecophilous species. In reply to a question by Mr. Howard, Mr. Schwarz said that no observations on the relationship of this *Tachys* to the ants had been made so far, and it was not known whether or not it fed on the eggs or young larvæ of the ants.

Mr. Ulke exhibited also a collection of Coleoptera made the present year by his son, Mr. Titus Ulke, in the Black Hills district of South Dakota. He said that the insect fauna of this region generally resembled that of Nebraska, but with a greater admixture of boreal forms. He remarked on the value of local collections of this sort to enable us to form correct ideas of geographical distribution.

Dr. Marx stated that of nine spiders received from Mr. T. Ulke, from the Black Hills, four were known and five were new species.

Mr. Schwarz said that he was glad to learn that Mr. Titus Ulke was collecting material toward a general catalogue of the insects of the Black Hills region of South Dakota. The only catalogue of insects of all orders that has hitherto been published in this country was that by Prof. J. B. Smith on the insects of New Jersey, but there were serious faults to be found with this work. In order to be useful to the collector as well as to entomological science, a catalogue should be based upon actually collected material. In Mr. Smith's catalogue, however, we find—except in Coleoptera, Lepidoptera and Orthoptera—hundreds of species enumerated which have never been collected in New Jersey. It appeared that, in the absence of collections, Mr. Smith selected from general catalogues and check-lists all such species which he thought likely to occur in his State. As a consequence this portion of the catalogue does not represent our actual knowledge of the insect fauna of New Jersey and fails, therefore, to accomplish the principal objects of a work of this character, viz: to form

a basis and guide for future exploration of a certain region, and to be a contribution to our knowledge of geographical distribution of insects.

Mr. Howard stated that in the Hymenoptera Prof. Smith had largely followed Cresson's Catalogue, and had included as from New Jersey those species against which Cresson has placed "U. S." In many cases Cresson, however, has recorded the United States as the habitat of species only actually found in two or three rather widely separated localities, so that to record such species as from New Jersey is very rash. Moreover, among the parasitic Hymenoptera both Cresson and Smith seem to have taken it for granted that where a parasite has been bred from a host, its geographical range is the same as that of the host insect. The fallacy of this is shown in the fact that Cresson catalogues *Euplectrus comstockii* Howard, a common parasite of *Aletia xylina* Say, as from "U. S.," and Smith consequently catalogues it from "N. J.," whereas this parasite occurs only, so far as we know, in the breeding region of Aletia, viz: the southern States.

Mr. Townsend presented the following paper:

THE NORTH AMERICAN GENERA OF CALYPTRATE MUSCIDÆ.

Paper I.

By C. H. Tyler Townsend.

The super-family name Muscina may be used with much propriety to designate the whole natural division of the Diptera comprehended in the term *Muscidæ sens. lat.* This division has long been divided, for convenience sake, into two great sections: the *Muscidæ calyptratæ* (also written *calypteræ*), as opposed to the *M. acalyptratæ*. The former are commonly supposed to be distinguished from the latter by the possession of large and well developed tegulæ, which in the *acalyptratæ* are defined as rudimentary or absent. In reality, however, no true line of separation can be drawn; for, as Mr. van der Wulp very aptly remarks, "when the numerous species are examined, the tegulæ are found to decrease gradually in size till they finally disappear altogether" (Biol. Centr.-Amer.; Dipt., II, p. 2). It was thought at one time that another

character might be of some service here. Haliday drew attention to the transverse suture of the thorax, which he believed to be usually of the same depth through its whole extent in the *Calyptratæ*, but generally distinct at each side and imperceptible in the middle of the thorax in the *Acalyptratæ* (Lœw, Mon., I, p. 33). This character, likewise, can not be relied upon. Similar difficulties arise in the separation of these flies into groups or families. Distinguishing characters are not so apparent here as in other families, nor are the characters most to be relied upon so constant. It is therefore difficult to arrive at a just decision concerning the location of some forms, until one becomes familiar with the genera. The best plan to follow in all doubtful cases is that of comparing the specimen with generic descriptions until its affinities are clearly ascertained.

I have followed Brauer and von Bergenstamm's work (to be presently noticed) in the inclusion of the *Œstridæ* with the *Calyptrate Muscidæ*. This scheme is not original with these authors. Lœw expressed this idea in 1862 (l. c.). The *Œstridæ* have always been recognized, especially so in more recent years, as possessing many characters in common with the *Muscidæ*. Their rudimentary proboscis is about the only character upon which they can be isolated. Their pilosity, though not seen in the *calyptratæ*, is paralleled in the *acalyptratæ* (*Cordyluridæ*). They possess its Muscid facies, the same venation, the undeveloped empodia, and the dorsal never terminal arista. The question of their parasitism naturally links them with the *calyptrate Muscidæ*, the first five families of which are, without exception, parasitic in their habits; while the infliction of this parasitism on the higher animals, and even man, is analogous to the pseudo-parasitism of *Compsomyia*, and the true parasitism of *Sarcophaga* on Reptilia. In this connection it should be noticed that *Ctenostylum* (*Œstridæ*) has the tegulæ very small, almost wanting; this fact, however, does not invalidate the present conception of the family, as all the other genera possess usually large, but sometimes smaller ciliate, tegulæ. I can see no reason why the *Œstridæ* should not be admitted into the *Calyptrate Muscidæ* as a sub-section on an equality with the *Creophilæ*, *Anthophilæ*, etc., and for which the term *Mammophilæ* might be proposed. The *Tachinidæ sens. lat.* may also very appropriately constitute a separate sub-section, distinguished from the *Creophilæ* (as thus restricted) by the absence of hair on the arista, and for which I coin the name *Entomophilæ*. This gives us four natural, and nearly equal, sub-divisions of the *Calyptratæ*.

The super-family MUSCINA, then (understood to embrace all the *Muscidæ sens. lat.*, including the *Œstridæ*), may be known

by the following characters: Antennæ 3-jointed, the third joint always simple and with a dorsal arista; proboscis present (except in some bot-flies), usually short and fleshy, but sometimes long, horny and adapted for piercing; only one submarginal and always three posterior cells present, discal cell usually present but sometimes absent; pulvilli present, the empodia never developed pulvilliform. They have a true coarctate puparium, from which they emerge through a curved seam or lid in the anterior end (not through a slit in the back).

By far the most important works on our *Calyptrate Muscidæ* are two very recent ones: That of Mr. van der Wulp in the Biologia Centrali-Americana (Diptera, vol. II), begun in 1888 and still being published; and that of Messrs. Brauer and von Bergenstamm on the *Muscaria schizometopa*, published in 1889 in Vienna. The latter attempts a revolution in the classification of these flies, and though there are some good points in it there is much that ought not to be accepted. I have followed it in some minor particulars, but I do not adopt, even in the main, the views of these authors, who have brought forth a system that is in many respects more unnatural than the old one. Yet the plates of this work (11 plates; 310 figures, mostly of heads alone) are well drawn, and may be found useful.

Mr. van der Wulp's work is particularly valuable as collecting all the tropical North American forms so far known, and presenting the full results not only of the rich collections made under the direction of the Biologia publishers, but also of the collection of Prof. Bellardi in Turin. The work gives excellent synopses of all the genera and species, and includes many forms not before known as inhabiting this country.

Though the *Acalyptratæ* have been studied in this country (by Lœw), the *Calyptratæ* have received no systematic attention from American students. Not that they are an unattractive group, for many of them are our most interesting and showy flies, and always invite the attention alike of the collector and the student. But incomplete, wrongly referred and scattered descriptions in works difficult to obtain, detailing insufficient or misinterpreted characters and involving a complex and intricate synonymy, have unfortunately deterred many workers from devoting their attention to this section of the *Muscidæ*. This paper, it is hoped, will, with others to follow it, serve the important object of bringing together all the North American genera described and recognized up to the present time, and at the same time enable their separation with a fair degree of certainty. Many new forms will have to

be added in the future, but such can more easily be recognized when the known ones are tabulated.

I have given the groups of Schiner family rank to which I believe they are entitled.

As to the larval habits of the *Calyptratæ* the general statement can be made that they are parasitic, pseudo-parasitic, creophagous, necrophagous, coprophagous and vegetarian. The sub-sections may be summarized as follows: *Mammophilæ*, parasitic exclusively on mammals; *Entomophilæ*, parasitic exclusively on other insects (Lepidoptera, Coleoptera, Hemiptera, Hymenoptera, Orthoptera); *Creophilæ*, including all the true flesh flies, some species being pseudo-parasitic on mammals, others coprophagous, some even parasitic in lepidopterous larvæ, and a few breeding in vegetable matter; *Anthophilæ*, breeding as a rule in decaying vegetable matter, but being also largely coprophagous and even parasitic.

TABLE OF FAMILIES.

Super-family MUSCINA.

Section *MUSCIDÆ CALYPTRATÆ*.

1. Mouth parts rudimentary, wanting or deeply sunken; palpi rarely present; vibrissæ and macrochætæ absent; apical (first posterior) cell wide open, narrowed, or closed and petiolate; usually piliferous flies (subsection *Mammophilæ*)............fam. **Œstridæ**

   Mouth parts well developed; palpi rarely wanting; vibrissæ present; bristly or bare; never piliferous flies....................................2

2. Fourth longitudinal vein bent up toward the third, forming an apical cross-vein, thus closing or more or less narrowing the apical cell..3

   Fourth longitudinal vein straight, the apical cell wide open, not narrowed in the border (subsec *Anthophilæ*)......fam. **Anthomyiidæ**

3. Arista naked,* or with only a very delicate and usually scarcely perceptible pubescence (subsec. *Entomophilæ*)................................4

   Arista distinctly hairy and usually feathered (subsec. *Creophilæ*)......8

4. Abdomen almost naked or with irregular, short, bristly hairs, never with long, regularly arranged macrochætæ (true or stout bristles)†..5

* *Rhynchomyia* and *Gymnostylina*, European genera usually classed with the *Muscidæ s. str.*, have a nearly naked arista; they have not yet been recognized in this country. On the other hand, some genera of *Tachinidæ s. str.* have the arista very distinctly pubescent but not hairy.

† *Miltogramma* and some allied genera, of the *Tachinidæ s. str.*, are without macrochætæ; but they all have a short conical, arched abdomen, and may thus be distinguished from the *Gymnosomatidæ*, which have the abdomen spherical.

Abdomen bristly or hairy, in either case with regularly arranged macrochætæ, sometimes spiny 6

5. Abdomen with five or six segments, rounded or elongate, usually more or less flattened, but sometimes cylindrical in the ♀; wings broad and large .... fam. **Phasiidæ**

Abdomen with only four segments, short oval, almost spherical, never flattened; wings proportionately short and small .... fam. **Gymnosomatidæ**

6. Abdomen with five segments (the first often indistinct),* elongate, cylindrical, more rarely short oval, either gently incurvate its whole length or the final segments strongly contracted and drawn in; genitalia strongly protruded 7

Abdomen with only four segments, short oval, conical, less often cylindrical, in the last case not incurvate behind and the genitalia not protruded .... fam. **Tachinidæ** s. str.

7. Abdomen elongate, cylindrical, contracted at the base, incurvate its whole length, the last segments not conspicuously narrowed and not drawn in .... fam. **Ocypteridæ**

Abdomen short oval or cylindrical, not contracted at the base, not incurvate its whole length, the last segments conspicuously narrowed and drawn in .... fam. **Phaniidæ**

8. Arista bare on the apical half;† macrochætæ present at least on the last two segments of the abdomen .... fam. **Sarcophagidæ**

Arista feathered or pubescent to the tip 9

9. Abdomen cone-shaped, cylindrical or elongate oval, with macrochætæ on each segment; legs usually elongate .... fam. **Dexiidæ**

Abdomen short oval, moderately broad and almost always somewhat compressed, without macrochætæ on any of the segments,‡ at most with bristly hairs on the last segments; legs always proportionately short .... fam. **Muscidæ** s. str.

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*If the first segment is indistinct, the other four segments will be found always of the same length; whereas if only the last three segments are of equal length, then the shortened forward segment is the first one.

† *Onesia*, belonging in the *Sarcophagidæ*, has the arista feathered more than half its length, but may be distinguished by the macrochætæ on the last two segments.

‡ In very rare instances, as in a single European species of *Lucilia*, there are macrochætæ on the middle segments.

TABLES OF GENERA.

Fam. Œstridæ.

The larvæ of these flies are true bots.

1. Proboscis geniculate, deeply sunken in a long, narrow, oral slit; palpi wanting; arista plumose on the upper side (sub-fam. *Cuterebrinæ*)....2

Mouth parts wanting, or rudimentary and lying in a slight concavity, the head below having a closed appearance; palpi sometimes present; arista naked (sub-fam. *Œstrinæ*)....3

2. Third antennal joint short, oval or elliptical; front not strongly produced; abdomen vaulted, oval; tarsi broad and flat, bristly.....gen. **Cuterebra**

Third antennal joint much elongate; front strongly produced over the face; abdomen flat; tarsi thin and delicate...gen. **Dermatobia**

3. Face with a median furrow, with or without a longitudinal dividing ridge....4

Face with a broad, shield-shaped surface....5

4. Median furrow very narrow; apical cell widely open, not narrowed in the border....gen. **Gastrophilus**

Median furrow wide; apical cell distinctly narrowed, or closed....6

5. Palpi wanting....gen. **Hypoderma**

Palpi small, spherical....sub-gen. **Œdemagena**

6. Median furrow without a dividing ridge its whole length; apical cell closed aud petiolate, no stump of a vein at the bend of the fourth longitudinal; body almost naked....gen. **Œstrus**

A narrow median ridge dividing the median furrow longitudinally; apical cell narrowly open, a stump of a vein at the bend of the fourth longitudinal; proboscis somewhat developed, with labellæ and large palpi; body pilose....gen. **Cephenomyia**

The following table for the determination of the larvæ is transcribed from Brauer's Mon. Œstr., 1863. It includes all the North American genera.

Larvæ in Third Stage.

1. Larvæ with two pairs of jaws: two curved upper jaws, the so-called mouth-parts, and two straight, horny lower jaws between the first; body abruptly truncate behind, wider than in front; stigmata on the last segment in a cavity which opens outwardly through a transverse fissure, concealed, in the form of three

pairs of longitudinal slits in the so-called arches; antennæ with one ocellus-like dot; anterior stigmata sunken, not visible on the outside..gen. **Gastrophilus**

Larvæ in the last stage with membranaceous oral margins, without jaws (very young larvæ are cylindrical, with microscopic mouth-parts, between which is a straight process; in the second stage they have horny oral margins in the shape of a V, with the body behind thin, tail-like); two horny rings above the mouth as rudiments of the antennæ; body at anterior end thinner than behind, but sometimes the last ring also very thin; stigmata on the last ring in the form of horn-like plates, free; anterior stigmata like minute dots, scarcely visible..............................2

Larvæ with one pair of jaws, membranaceous oral margins and small membranaceous antennæ...3

2. Spines differently disposed on the upper and under sides; body much less spiny above....................................gen. **Hypoderma**

Spines developed and distributed almost alike on the upper and under sides..subgen. **Œdemagena**

3. Last abdominal segment free, but never deeply cut off from the preceding one, perhaps forming an appendage, but narrowly joined to the preceding and not drawn within it, posteriorly truncate or deeply hollowed above and elongated into a trunk below; stigmatal plates on the last segment either free or lying in a cavity formed entirely by this segment, horny; anterior stigmata small, round, almost button-shaped, horny..............................4

Last abdominal segment drawn into the preceding one, much narrower and shorter than the latter, the larva thereby appearing to have one segment less (in young larvæ the last segment often forms a cup-shaped appendage); antennæ with two ocellus-like dots; dorsal surface convex longitudinally, ventral surface concave in the same profile; anterior stigmata in the form of a long, narrow, transverse slit with wrinkled edges..............................5

4. Antennæ widely separated at the base; posterior stigmatal plates irregularly 5-sided, roundish, the false opening entirely enclosed in the plate; two ocellus-like dots on each antenna.................. gen. **Œstrus**

Antennæ contiguous at the base, each with two ocellus-like dots; stigmatal plates moderately free, situated on the slightly concave, truncate, posterior side of the last segment..................... gen. **Cephenomyia**

5. Larva oval, thick, densely beset with spurs or scales, only the first and last segments almost naked; stigmatal plates on the last segment horny, semi-lunar..............................gen. **Cuterebra**

Larva elongate pear-shaped, thicker in front than behind, beset with only a few transverse rows of spurs; stigmata on the last segment in the form of three longitudinally cleft arches of the *Gastrophilus* type...gen. **Dermatobia**

Cephenomyia Latrieille, Fam. Natur. (1825). Ga.; N. W. Terr.; Cal. Parasitic in necks of deer. Reported found in hogs in W. Va. (See Insect Life, U. S. Dep. Agr., III, 161–162). Also, reported from nose of man (l. c. II, 116).

Cuterebra Clark, Essay on Bots. (1815.) Syn. *Trypoderma* Wied. U. S.; Nova Scotia; Vancouver; Mexico; Guatemala. Rodents.

Dermatobia Brauer, Verb. Z.—b. Ges. (1860.) *D. cyaniventris* Mcq. is known from Central America. This genus is parasitic on man, dogs. A larva, doubtfully, and probably incorrectly referred to this genus, was reported from Mississippi by Verrill (Insect Life, I, 226).

Gastrophilus Leach, Gen. sp. Eprob. Ins. (1817.) Syn. *Gastrus* Meig. Nova Scotia; N. A.; Jamaica. Horses.

Hypoderma Clark, Essay on Bots. (1815.) Nova Scotia; N. A. Oxen, buffalo, sheep?, deer, man. (See Insect Life, II, 238–239).

Œdamagena Latreille, Fam. Natur. (1825.) N. A. Reindeer.

Œstrus Linné, Fauna Suecica. (1761.) N. A. Sheep.

Fam. **Phasiidæ.**

The larvæ are parasitic, as far as known, on plant-bugs and beetles.

1. Abdomen elongate oval or oblong, often cylindrical in the ♀, beset at least toward the extremity with moderately long, generally irregularly arranged, bristly hairs..2

   Abdomen shorter, rounded, almost naked or with only fine and short pubescence..3

2. Hind tibiæ lashed or ciliate; antennæ short; epistoma prominent; apical cell closed; hind cross-vein doubly arcuate; abdomen of ♀ cylindrical; claws of ♂ elongate....................gen. **Trichopoda**

   Hind tibiæ not ciliate; apical cell closed (in our species); antennæ short, third joint somewhat elongate; front not produced, epistoma prominent; hind cross-vein curved; abdomen swollen; claws strong, nearly alike in both sexes.....................gen. **Xysta**

3. Apical cell open; abdomen broader than the thorax; wings very wide, almost triangular; fourth longitudinal vein bent at an angle; hind cross-vein twice curved; third antennal joint not longer than the first and second together, the arista distinctly 3-jointed. gen. **Phasia**

Apical cell closed in the border at the apex of the wing; wings longer than the abdomen, not widened and triangular; flexure of the fourth longitudinal vein rounded; hind cross-vein somewhat curved; antennæ half as long as the face, third joint nearly twice as long as the second..............................gen. **Acaulona**

Apical cell closed and petiolate..............................4

4. Fourth longitudinal vein bent at an angle to meet the third; petiole of the apical cell very long; hind cross-vein near the middle of the apical cell; face with a median carina....gen. **Himantostoma**

Fourth longitudinal vein nowhere bent at an angle, but describing a curve to meet the third; wings very wide (gen. *Alophora sens.* Schin.)..............................5

5. Hind cross-vein nearer to the bow of the fourth longitudinal than to the small cross-vein; petiole of the apical cell moderately long, first longitudinal vein elongate..................gen. **Alophora** *s. str.*

Hind cross-vein situated at or before the middle of the distance between the bow of the fourth longitudinal and the small cross-vein; petiole of the apical cell long, first longitudinal vein not elongate..............................subgen. **Hyalomyia**

Acaulona v. d. Wulp, Biol. Centr.-Am., Dipt., II, 4. (1888.) Mexico (Orizaba; Vera Cruz). Larval habits unknown.

Alophora Rob. Desvoidy, Myod., 293–4. (1830.) Nevada, Rocky Mts. [Bigot, Ann. Soc. Ent. Fr., 1888, 255.] The habits of the European *A. dispar* were discovered by L. Dufour. The larva lives parasitically in the body of *Brachyderes lusitanicus* (Schiner). The species referred to this genus by Bigot perhaps belong to *Hyalomyia*. We have no other authority for its occurrence in North America.

Himantostoma H. Lœw, Centur. IV, No. 87. (1863.) ♂. Illinois. Larval habits not known.

Hyalomyia Rob. Desvoidy, Myod., 298. (1830.) New York; District of Columbia; Dakota; Pacific Coast. Larval habits probably same as **Alophora**.

Phasia Latreille, Hist. Nat. Crust. et des Ins., XIV, 379. (1804.) The larval habits of a European species are known. L. Dufour found the pupa in the body of a *Pentatoma grisea*. The larvæ are parasitic on the adults of other insects (Schiner). This genus has been wrongly identified as occurring in North America.

Trichopoda Latreille, Cuv. Règne An., V. (1829.) United States; Mexico; Guatemala; West Indies. This genus, rich in species, is peculiar to the American continents. Its habits have never been recorded.

Xysta Meigen, Syst. Beschr., IV, 181. (1824.) Illinois. Larval habits unknown.

Fam. Gymnosomatidæ.

Cistogaster is placed in the *Phasiidæ* by Brauer and v. Bergenstamm. I consider the number of abdominal joints a better character than the slight facial differences employed by these authors for family characters, and retain it with *Gymnosoma*.

The larvæ of these flies, so far as known, are parasitic on plant-bugs.

Antennæ reaching almost or quite to the epistoma; abdomen globose, having a decidedly inflated or swollen appearance; apical cell closed and petiolate.................................... gen. **Gymnosoma**

Antennæ reaching only half way to the epistoma; abdomen short oval, sometimes nearly round; apical cell petiolate, closed in the border, or even narrowly open ....gen. **Cistogaster**

Cistogaster Latreille, Cuv. Règne An., V. (1829.) Nova Scotia; United States. The larval habits of this genus are unknown.

Gymnosoma Meigen, Illig. Mag., II, 278. (1803.) Nova Scotia; United States. The larvæ, on the authority of v. Heyden, are parasitic in the bodies of *Pentatomidæ* (Schiner).

It is rather remarkable that neither of the above genera has ever been found in Mexico or Central America, although *Gym. filiola* H. Lw. has been identified by Mr. v. Röder from Porto Rico. With this single exception, the family seems to be peculiar to the north temperate zone.

Fam. Ocypteridæ.

The larvæ of these flies have so far been found parasitic only on *Pentatoma* and *Cassida*.

1. Apical cell open (sometimes very narrowly)....................................2
   Apical cell closed and petiolate; third antennal joint flattened, once or twice as long as the second; epistoma more or less prominent; apical cross-vein angulate at its origin........gen. **Ocyptera**

2. Third antennal joint longest...3
   Second antennal joint longer than the third....................................4

3. Third antennal joint only about three times the length of the second, widened into an equilateral triangle in the ♂, much widened at the apex in the ♀; hypopygium not bent under the abdomen...gen. **Lophosia**

Third antennal joint five or six times the length of the second, of equal width ; second aristal joint three times as long as the first ; hypopygium bent under the abdomen ....gen. **Hemyda**

4. Apical cell opening before the tip of the wing ; face a little oblique ; antennæ of medium length.................................gen. **Ervia**

Apical cell opening at or very near the tip of the wing ; face straight ; antennæ reaching the epistoma, the third joint narrow, obtuse... gen. **Ancylogaster**

Ancylogaster Bigot, Bull. Soc. Ent. Fr., 1884, 69–70. ♂. Mexico. Larval habits unknown.

Ervia Rob. Desv., Myod., 225. (1830.) Carolina. Larval habits unknown.

Hemyda Rob. Desv., Myod., 226. (1830.) Philadelphia ; Missouri (v. Röder, Berl. Ent. Zeitschr., XXV, 212). Larval habits unknown.

Lophosia Meigen, Syst. Beschr., IV, 216. (1824.) California. Larval habits unknown.

Ocyptera Latreille, Hist. Nat. Crust. et des Ins., XIV, 378. (1804.) Newfoundland ; Nova Scotia ; United States ; Mexico ; W. Indies. The larval habits of the European *O. bicolor* (*coccinea* Meig.) are known ; the larva is parasitic in the body of *Pentatoma grisea*. The larva of a second species was found in the body of a *Cassida* (Schiner).

NOTE.—Robineau Desvoidy's genus *Parthenia* was separated from *Ocyptera* on very insufficient grounds, and I have not revived it.

Fam. Phaniidæ.

The larvæ have been found parasitic only in the adults of beetles.

Hind cross-vein nearer to the flexure of the fourth longitudinal than to the small cross-vein, curved ; apical cell open at the tip of the wing ; third antennal joint two or three times as long as the second (gen. **Phania** sens. Schiner) ; vibrissæ short and fine, not decussate..subgen. **Evibrissa**

Hind cross-vein about half way between the small cross-vein and the flexure of the fourth longitudinal, which is arcuate ; apical cell closed and petiolate ; antennæ short, third joint only once or twice the length of the second........................gen. **Wahlbergia**

Evibrissa Rondani, Prod. Dipt. Ital., IV, 74–75. (1861.) Washington Territory [Bigot, Ann. Soc. Ent. Fr., 1888, 256]. Larval habits unknown. This is properly a subgenus of *Phania*. The species which has been referred to this genus may possibly belong to *Wahlbergia*.

Wahlbergia Zetterstedt, Dipt. Scand., III, 1223–1224. (1844.) Nebraska; Indiana (Say, *Ocyptera*); District of Columbia. Larval habits unknown.

The habits of *Uromyia** and *Gymnopeza*, genera of *Phaniidæ*, are known. Boheman bred the European *U. curvicauda* from larvæ which lived parasitically in the bodies of *Harpalus aulicus* and *H. ruficornis*; and a species of *Gymnozega* supposed to be identical with *G. denudata* Zett. was bred by Mr. v. Tacchetti from the body of a *Carabus scheidleri*, which he had found dead in a highway (Schiner).

It is also remarkable that none of the *Phaniidæ* have been reported from Mexico or Central America, although representatives of them have been described from South America.

NOVEMBER 6TH, 1890.

Fourteen persons present. President Marx in the chair.

Mr. Erwin F. Smith was elected an active member of the Society.

Under exhibition of specimens and notes, Mr. Schwarz exhibited a larva of the genus *Carabus*, with singularly deformed maxillary palpi. The right palpus is normally formed except that the suture between the first and second joints is nearly obliterated; the left palpus is only three-jointed, with the joints nearly transverse, as in *Calosoma*. This remarkable larva, apparently a full-grown specimen, was found early in September near Washington, D. C.

Mr. Marlatt presented the following:

* The genus *Uromyia* was described by Meigen in 1838 for a *Phaniid*. Robineau Desvoidy had already described (1830) his genus *Uramya* for a *Dexiid*, a species of which, *U. producta* R. D., originally from South America, is recorded from Central America by Brauer and v. Bergenstamm, who spell the genus the same as Meigen's (Musc. schiz., 130). These two genera should not be confounded; it would be well for some European author to substitute another name for Meigen's genus, which does not occur in this country.—C. H. T. T.

NOTES ON THE GENUS METOPIUS, WITH DESCRIPTION OF A NEW SPECIES AND TABLE OF SPECIES.

By C. L. Marlatt.

Prof. Riley recently received from Mr. Lawrence Bruner a peculiar Ichneumonid which had been collected in South Dakota by Mr. J. M. Aldrich. An examination showed at once that it was a female belonging to the genus *Metopius*. I recalled having collected two specimens of a closely allied, if not the same, insect in Kansas, and had them forwarded to me. They were duly received, and proved to be identical with the Dakota specimen, and were both females. These three females, together with two additional females received later from Mr. Aldrich, while belonging undoubtedly to the genus *Metopius*, differ in a very striking manner from males of several species in the National collection—there being no females represented—and might even be considered to belong to an entirely distinct genus. So strikingly do they differ from the males seen, and from the description of the genus by Gravenhorst, and later by Brullé, and also from all the descriptions of females, most of which I have been able to consult, that it struck me very forcibly at first that perhaps a female of this genus had never been characterized, and that the supposed females described were in reality males! Examination, through the kindness of Mr. Cresson, of the specimens of this genus in the collection of the American Entomological Society at Philadelphia, subsequent to the reading of this paper, showed me that I was in error in this, but indicated very plainly that my specimens differed very materially from all other described species and also in important particulars from the genus as at present understood.

The genus *Metopius* is perhaps better characterized and more distinctly separated from other genera than any other genus of Ichneumonidæ. The peculiar features are the very prominent shield on the face, the antennæ, the character of the thorax and venation of the wings, in all of which particulars my specimens agree; but the description of the genus by Gravenhorst and Brullé, and also of all the species which I have been able to consult, agree in describing the abdomen of both the male and female as completely depressed—at first with the sides nearly parallel, and then slightly widening posteriorly. The ovipositor is said to be nearly concealed, and in the case of the females examined by me, and so far as indicated by the descriptions of the others, is of small size, not exceeding, when fully exserted, one-fourth the length of the abdomen.

In the case of the specimens under discussion, however, the abdomen tapers rapidly from the base to the apex, which is pointed and decidedly compressed. The ovipositor is enormously large in comparison with the size of the insect, being of sufficient size to nearly fill the abdomen from base to apex, and when fully exserted, as it is in the case of two specimens, is with the large basal portion nearly twice the length of the abdomen. With the other specimens the ovipositor is but slightly exserted, or almost entirely redrawn into the abdomen.

The striking character of the ovipositor of this insect is shown in the accompanying illustration. The ovipositor includes with supports the 7th and 8th abdominal segments, and

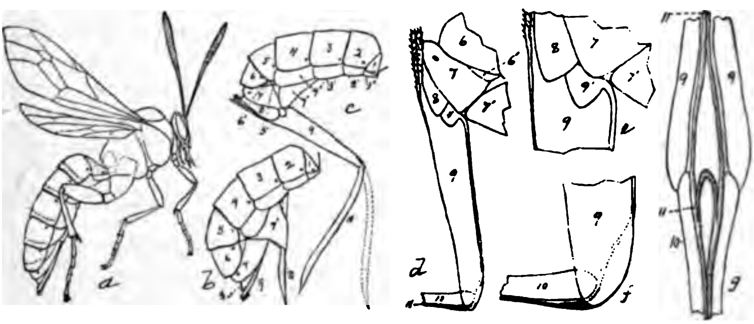

FIG. 5.—*Metopius rileyi*: *a*, female from side; *b*, abdomen of same, showing ovipositor partly exserted; *c*, same, with ovipositor entirely exserted; *d*, *f* and *g*, terminal segments of abdomen and parts of ovipositor still more enlarged (original).

all these parts are uniformly shining and reddish-black in color. The connection between the base of the support (9) and segments 7 and 8 is very intimate—the lines in the illustration indicating the union of the plates appearing as scarcely perceptible sutures. The support (9) is deeply grooved beneath, or rather consists of two plates, and the ovipositor proper (10) closes into it like the blade of a knife. At the extreme base of the support and projecting slightly posteriorly, are the hairy sheaths, and at the tip of the 8th segment are the minute stylets found in most Hymenoptera.

The ovipositor proper consists of the customary three parts, viz: the sheath or lower envelope (10) and two spiculæ (11). The base of former is enclosed by and quite firmly attached to the apex of the support, with which it forms a sort of ball and socket joint (Fig. 5, *d*, *f* and *g*). The spiculæ branch near the base of the sheath; the inner branches unite,

forming a loop, and the outer pass over the enlarged base of the sheath, and continue along the upper edge of the support and unite with plate 9'. The parts are shown somewhat separated at *g*, to better indicate their relation. The open spaces between the spiculæ and the support are enclosed by a membrane which forms with these parts a closed passage for the egg from the abdomen to the ovipositor proper.

Another peculiar feature is the great size and abnormal position of what apparently corresponds with the 7th ventral arc of the abdomen 7'. The outer portion of this arc or plate is tough, and in texture and color resembles segments 7 and 8 and the support 9; the inner portion is thinner and more flexible and lighter in color, becoming membranous at the point of attachment. It is attached within, and is, when the ovipositor is entirely redrawn, nearly concealed by the 3rd to 5th ventral arcs, as shown at *a*. As the ovipositor is thrust out this arc is considerably drawn out, as represented at *b*, and to thrust the ovipositor quite out, as represented at *c*, it would seem that this sheath must necessarily be ruptured; but this is not the case with the two specimens collected having the ovipositor fully extended, and probably never occurs. The explanation undoubtedly is that as the ovipositor is pushed out this sheath-like plate slips back and the terminal segments extend and separate at the same time sufficiently to free the ovipositor.

Nothing is known of the breeding habits of the American species of *Metopius;* the specimens collected by me were taken in the fall on *Solidago* bloom and in company with *Trypeta solidaginis*, and it is possible that the *Metopius* is parasitic on this Dipteron, the powerful ovipositor of the female being well suited for piercing the Trypeta galls. The breeding records of European species—ascertained for me by Mr. Howard—do not support this belief, as they show that the rearings have been from various Bombycids, a Noctuid, and one doubtful one from *Lophyrus pini.*

I have altered the characterization of the genus *Metopius* to allow of its including this anomalous species, which I take pleasure in dedicating to Prof. C. V. Riley, whose interest and work in the parasitic Hymenoptera are well known.

Metopius Gravenhorst.—*Head* transverse, short; face scutatiform, sub-concave, with elevated margins; eyes oval. Antennæ ranging from short and somewhat spindle-shaped to long and of nearly uniform thickness throughout. *Thorax* convex; scutellum quadrangular, with prominent posterior angles and carinate lateral margins. *Wings* medium, areolet large and rhomboidal. *Abdomen* sessile, usually compressed

throughout and widening posteriorly ; in some species, however, narrowing uniformly from the base to apex, which is somewhat compressed; ovipositor capable of being almost entirely redrawn into the abdomen, and generally of small size—occasionally exserted, however, and large and powerful. The males have attached to the terminal ventral plate of the abdomen two curved appendages, forming a sort of pincers, which is supposed to be of service in copulation. *Legs* medium, posterior femora thickened; tarsi longer than tibiæ, which are armed with two spurs at tip.

Metopius rileyi, n. sp.—♀ Black ; spot beneath the antennæ, scape beneath, line on inner orbit, line below base of wings, apex of scutellum and line behind, two spots at side of meta-thorax apex of all the abdominal segments, exterior of anterior tibiæ and apex of posterior femora, lemon yellow ; base and apex of antennæ and legs fusco-ferruginous, posterior femora almost black, trochanters reddish ; antennæ one-third length of body, thickened toward apex ; wings fuliginous, distinctly darker on anterior half, hind apical portion hyaline ; thorax and abdomen coarsely punctured ; abdomen narrowing uniformly from base to apex and compressed at apex, oviposits extremely large and with large basal portion or support when retracted almost entirely filling the abdomen. Length 8-10 mm.

Described from five specimens—all females—collected in Kansas and South Dakota.

The following table will assist in the determination of the North American species of this genus :

TABLE OF SPECIES.

1.—General color black.. 2
General color yellow and ferruginous........................*pulchellus* Cr.
2.—Abdomen entirely black..*hageni* Cr.
Abdomen more or less marked with white or yellow........................3
3.—Wings hyaline or yellowish hyaline..4
Wings more or less fuliginous..6
4.—Abdomen mostly yellowish white or ferruginous; scutellum basally black 5
Abdomen mostly black ; scutellum entirely yellow...........*scitulus* Cr.
5.—Abdomen sulphur yellow ; segments more or less black basally........ *montanus* Cr.
Abdomen with base of segments 1-3 and middle of 4 ferruginous...... *comptus* Cr.
Abdomen pale yellow ; base of segments 1-3 black ; remaining segments each with two black spots at base..................*bellus* Cr.
6.—Costal margin distinctly darker..7
Costal margin not distinctly darker..12

7.—First segment of abdomen entirely yellow.............................. 8
First segment black at base.. 9
8.—Following segments yellow and ferruginous............. *mirandus* Cr.
Following segments with basal black band, widest on segments 2 and 3...*concinnus* Cr.
9.—With yellow spot at side of apex......................... *laticinctus* Cr.
With broad yellow or white band at apex................................ 10
10.—Scutellum white, legs marked with black...................*robustus* Cr.
Scutellum yellow, legs rufous.................................*rufipes* Cr.
Scutellum black at base.. 11
11.—Second segment black with lateral yellow spots..........*edwardsii* Cr.
Second segment with yellow band at apex.....................*rileyi* n. sp.
12.—Second, third and fourth segments of abdomen rufous..................
**terminalis* Ashm.
Second and third segments black, marked with yellow...............13
13.—Stigma fuscous, first segment with broad yellow band at apex.........
pollinctorius Say
Stigma yellow, first segment with two yellow spots at apex............
xanthostigma Ashm.

Mr. Howard read the following paper:

THE HABITS OF PACHYNEURON.

BY L. O. HOWARD.

Pachyneuron is a genus of hymenopterous parasites of the family *Chalcididæ*, sub-family *Pteromalinæ*, and tribe *Sphegigastrides*. It is composed of small species, all under 3 mm. in length, of metallic colors—usually rather dull—large heads, flat, oval abdomens, and not very active habit. Six European and six North American species have been described. Three of the six European species were described from captured specimens, and nothing is known of their habits. Of the other three Bouché evidently reared his *P. aphidis* from some plant-louse; Ratzeburg says of his *P. coccorum*: "1 ♀ from

* This species is certainly wrongly referred to the genus *Metopius*. In addition to the fact, noted by Mr. Ashmead, that the facial shield is entirely wanting, it differs from the genus in venation—the areolet being small, triangular and petiolate instead of large and rhomboidal—and also in character of thorax and abdomen. The scutellum approaches that of *Metopius* but is longer and narrower than in any described species known to me. This insect may be referred to the genus *Tryphon*, with which it agrees in every particular except that the metathoracic spiracles are slightly oval instead of round.

Herr Reissig, who reared it with *Encyrtusæneus*, from Coccus. Later I reared a male from *Chermes piceæ*"; and of the third, Foerster says: "I have reared it from a plant-louse—a *Pemphigus*—and Herr v. Heyden, at Frankfort, reared it most probably from the same plant-louse on *Pinus sylvestris*." This is all the information we get from European entomologists on the habits of *Pachyneuron*.

The genus was first recognized in this country when I found it in 1884 among some parasites reared by Mr. Hubbard, at Crescent City, Florida, during his work on orange insects. This species, which I described as *P. anthomyiæ* in Mr. Hub-

FIG. 6.—*Pachyneuron micans* Howard. Female—enlarged.

bard's Report on Orange Insects, was reared from the puparium of a dipterous insect, the larva of which fed upon *Aphis citrulli*, and which Dr. Williston was unable to determine as other than a probable new genus of *Anthomyiidæ*. (It is figured and described on page 185 of the report just mentioned). Mr. Hubbard kept the puparium of the fly, with the hole from which the *Pachyneuron* had emerged, and there was not the slightest doubt of the accuracy of the observation.

A few months later Prof. A. J. Cook sent me another species, which he wrote he had reared from a bark-louse on Blue Ash. For this I sent him the MS. name *P. altiscuta* (which he used in his next published report), and (having Mr. Hubbard's experience in mind) I asked him whether there had not been syrphid larvæ among his bark-lice, and whether this parasite might not have come from such a syrphid rather than from the coccid. He replied that there were syrphid larvæ among the lice, but that he thought the parasite had issued from the latter.

Soon after other material of Mr. Hubbard's came to my notice, and another species of *Pachyneuron* was found, which

had issued in large numbers from the puparia of *Baccha babista*, a syrphus-fly whose large larvæ he had found feeding also on the Orange Aphis. Another series he had reared from the large puparia of another *Baccha*, the larvæ of which had fed upon the Cotton Aphis (*A. gossypii*), and naturally both of these instances only confirmed my suspicions that Prof. Cook's species had come from syrphid larvæ and not from bark-lice. The idea was becoming fixed in my mind that *Pachyneuron* is normally a parasite of dipterous larvæ of the family Syrphidæ and its close allies, my experience with other groups of Chalcididæ having apparently shown me that speedy generalizations of this particular character are not rash.

Subsequent developments, however, speedily proved that no such absolute rule could be founded, and that, while the parasitism of *Pachyneuron* is not of the miscellaneous or heterogenous character found with *Pteromalus* or *Eupelmus*, species of each of which have been bred from hosts of four or five different orders, the former from larvæ and pupæ, and the latter from eggs, larvæ and pupæ of many widely differing insects, yet it is also not of a uniform, unvaried character. It may be said, in fact, to be of a *dual* nature, its species attacking, apparently indiscriminately, insects of two entirely distinct and well-defined groups, each belonging to a distinct order, and, curiously enough, and very unfortunately for the economic reputation of *Pachyneuron*, these two classes of hosts partake of the mutual relation of prey and predator—injurious insects and their direct and peculiar enemies—thus counterbalancing the benefits which our parasites might have produced had their tastes restricted them to the former class. Such instances have been very rare in my experience, and I only recall one other in the case of *Elasmus*, which attacks both microlepidopterous larvæ and the Microgasters which parasitize them. These two classes of the host-insects of *Pachyneuron* are, first, the closely-related homopterous families *Coccidæ*, *Aphididæ* and *Psyllidæ*, and second, their predatory dipterous enemies the *Syrphidæ* and (in one instance) *Anthomyiidæ*. When infesting *Aphididæ*, in no case has more than one parasite issued from a single plant-louse, but in the case of Mr. Hubbard's anthomyiid two specimens emerged from the host puparium, while with the large *Baccha*, according to Mr. Hubbard's published statement, the parasites "issue from the puparium in numbers varying from six to eighteen, through a number of small holes which they gnaw through its top and sides." A glance at the specimens, however, contradicts the latter portion of this statement, for there is but one hole

in each puparium, all of the parasites which have issued (and there are as many as nine in some cases) having utilized the orifice made by one hard-working individual.

The extended list which follows (extended in view of the paucity of our previous knowledge) Dr. Riley has permitted me to draw up from the National Museum collection, recently rearranged at his direction by Mr. Ashmead, and it is safe to say that there nowhere exists a collection of Microhymenoptera which exhibits such a wealth of bred forms. Collected specimens are also present which, from their labels, indicate that the species fly from February to October, while such notes as are at hand indicate that they are rapid breeders.

THE HOST-INSECTS OF PACHYNEURON IN THE UNITED STATES.

ON PSYLLIDÆ.

Pachyneuron sp. From Psyllid on Arbutus (undetermined); reared by Koebele, at San Mateo, Cal.

ON COCCIDÆ.

Pachyneuron altiscuta Howard. From Coccid on Blue Ash; reared by A. J. Cook, at Agricultural College, Mich.

Pachyneuron sp. From *Kermes gallæformis* Riley; reared at Washington, D. C.

Pachyneuron sp. From *Dactylopius citri* Boisd.; reared at Washington, D. C.

ON APHIDIDÆ.

Pachyneuron sp. From *Aphis pruni;* reared by H. Osborn, at Ames, Iowa.

Pachyneuron sp. From *Siphonophora viticola;* reared at Washington, D. C.

Pachyneuron micans Howard. From *Siphonophora avenæ;* reared at Lafayette, Ind., by Webster.

Pachyneuron micans Howard. From *Toxoptera graminum*, from Tennessee; reared at Washington, D. C.

Pachyneuron aphidivora Ashmead. From *Aphis brassicæ;* reared by Ashmead at Jacksonville, Fla.

Pachyneuron sp. From *Chaitophorus* on Populus; reared at Washington, D. C.

Pachyneuron sp. From *Phylloxera vastatrix* (leaf-galls); reared at Washington, D. C. (Specimens collected across the Potomac in Virginia).

ON ANTHOMYIIDÆ.

Pachyneuron anthomyiæ Howard. From puparium of an anthomyiid, larva feeding on *Aphis citrulli*; reared by H. G. Hubbard, Crescent City, Fla.

ON SYRPHIDÆ.

Pachyneuron sp. From syrphid feeding on *Myzus ribis*; reared by Webster, at Lafayette, Ind.

Pachyneuron sp. From syrphid feeding on *Aphis brassicæ*; reared by Koebele, at Alameda, Cal.

Pachyneuron sp. From syrphus puparium; B. D. Eastman; *loc.* ?

Pachyneuron syrphi Ashm. From syrphid puparium; reared by Ashmead, at Jacksonville, Fla.

Pachyneuron allograptæ Ashmead. From puparia of *Allograpta obliqua*, larvæ of which had been feeding on *Aphis brassicæ*; reared by Ashmead, at Jacksonville, Fla.

Pachyneuron sp. From puparia of *Baccha babista*, larvæ of which had been feeding on *Aphis citrulli*; reared by Hubbard, at Crescent City, Fla.

Pachyneuron sp. From puparia of *Mesograpta polita*, larvæ of which had been feeding on corn pollen; reared at Washington from specimens received from New Jersey; also reared by Ashmead, at Jacksonville, Fla.

Pachyneuron sp. From puparia of *Baccha* ? sp., larvæ of which had been feeding on *Aphis gossypii*; reared by Hubbard, at Centreville, Florida.

Thus we have records of twenty distinct rearings of species of this genus, and find that it is an enemy of such well-known pests as the grapevine Phylloxera, the grain plant-louse and the cabbage plant-louse, so that the Dr. Jekyll side of its two-faced character is extremely philanthropic. In addition to placing on record the anomalous features of the habits of the insects of this genus of parasites, the short historical summary of my own impressions will serve to point the old, old warning as to the danger of attempting a generalization without broad foundations and extended material.

Mr. Schwarz read the following paper:

CONTRIBUTION TO THE LIFE-HISTORY OF CORTHYLUS PUNCTATISSIMUS, AND DESCRIPTION OF C. SPINIFER N. SP.

BY E. A. SCHWARZ.

The food-habits of *Corthylus punctatissimus* remained unknown until, in the fall of 1882, Dr. C. Hart Merriam discov-

ered that in northeastern New York it lives in the subterranean part of the stems of young Sugar Maple saplings, and that this hitherto supposed rare Scolytid is, at least in northeastern New York, greatly injurious to that valuable tree. This discovery was certainly a most interesting one, but did not fully settle the question of food-plants, for I knew that specimens had been captured in places where there are no Sugar Maples; and this tree does also not grow in the vicinity of Columbia, S. C., where Dr. Zimmermann in all probability found the original specimens. It was to be suspected that this Scolytid had another food-plant, and this was unexpectedly discovered toward the end of September almost within the city limits of Washington, where the beetle was found in abundance in the roots of the common Huckleberry. The fact that it is the first Coleopteron known to affect the Huckleberry, and that it is one of the few Scolytids known to live in plants which are not tree-like, induced me to spend some Sunday's excursions during October to study the habits of this *Corthylus*. The observations are of course only fragmentary so far, since they were made at a season when the insect is already in its winter rest and in its winter quarters.

From Dr. Merriam's excellent account and figures (Amer. Nat., 17, 1883, pp. 84–86) it can be seen that the beetle, after entering the stem just at or very near to the surface of the ground, constructs a circular burrow within the wood close to the bark, but so that the furthest end of the burrow is always a little above or below the entrance hole. From this circular burrow a varying number of straight, short galleries lead off perpendicularly either upward or downward. Sometimes the beetle uses the bottom of one of these shorter galleries to dig deeper down in the stem, and to construct then a second circular gallery parallel with the upper one and possessing also the vertical shorter galleries. In rare instances Dr. Merriam observed also a third story of galleries. The vertical galleries are also excavated by the parent beetle, and are the larval cradles; one egg is laid in each, and the larva remains stationary, does not enlarge the cradle, and is a sap-feeder.

The work of the beetle in the roots, or rather subterranean stems, of the Huckleberry differs but slightly from that in Sugar Maple. The largest root of Huckleberry which I found to be infested measured not quite 10 mm. in thickness, and the smallest but little over 3 mm. It is, indeed, quite astonishing to see how this comparatively large beetle manages to make its circular burrow in such a narrow space; but I have also found infested stems where the beetle, after entering the stem, found it too thin, and left it on the shortest way, viz: by eat-

ing its way out just opposite the entrance hole. Most infested roots measure from 4 to 6 mm. in thickness. In this narrow space it is impossible for the beetle to make the circular gallery as nearly in the same plane as in the thicker Sugar Maple saplings, and the gallery is constructed in a more descending or ascending way along the axis of the root. It thus resembles usually the windings of a corkscrew, and is sometimes quite steep. The arrangement of the short vertical galleries or cradles in the Huckleberry is much less regular than in the Sugar Maple; the whole interior of the infested portion of the root appears to be honeycombed with them. A second or third story of galleries occur also in Huckleberries, but not often, and they are usually much less plain than in Dr. Merriam's figures. Since the Huckleberry roots are rarely vertical, but either more or less arched or crooked in various ways or horizontal for a long distance, and since the burrows of the beetle may occur in any part of the root (except in the thinner tip), from near to the surface of the soil to five or six inches beneath it, the galleries are directed sometimes upward, sometimes downward, and sometimes they are horizontal, but usually they run from the entrance hole in the direction of the tip of the root.

A novel feature in the knowledge of our Scolytid burrows is exhibited in a long, straight gallery through the core of the root, beginning at the top of the honeycombed portion and extending always upward, sometimes even above the surface of the soil. This gallery is never coated with the black substance seen in the regular galleries, and in it from three to six or even more beetles, one close behind the other, are met with. I have called it the hibernating gallery, for it is evident that it is made (of course only by the foremost beetle, the others can only help by pushing the sawdust behind themselves) solely for the purpose of having dry winter quarters remote from the regular galleries, where the wood becomes rotten and damp. This hibernating gallery occurs, however, not in all infested roots.

In the course of my observations I examined the roots and subterranean stems of all sorts of plants growing among the huckleberry bushes but without finding hitherto any other food-plant. The beetle appears to live only in the common Huckleberry of our markets, *Gaylussacia resinosa*, and I failed to find it even in two allied species, *Vaccinium stamineum* and *V. corymbosum*. It occurs, however, by no means wherever the *Gaylussacia* grows, but there are here and there infested areas of plants of larger or smaller extent, more especially in shady places, where the plants grow on a decayed log or

where the soil is covered with a thick layer of old leaves. On such places infested roots are by no means rare: every fourth or fifth will be found either to contain the beetles or to have been infested by a previous generation. The beetle is common in the localities thus far visited by me, viz: the hills along the Eastern Branch of the Potomac near Benning's Station, and along Rock Creek, and I have no doubt that it will be found equally abundant in other localities around Washington and elsewhere. In view of this fact it is strange that neither Mr. Ulke, in his thirty years' assiduous collecting near Washington, nor myself have ever found before a single specimen of the beetle here. The only explanation for this is, in my opinion, that the beetle is strictly subterraneous; that it appears only rarely above ground and rarely makes use of its wings, although both sexes are provided with such. The beetle seems to be perfectly at home in the soil and digs through the same with astonishing rapidity, while specimens which I took from their burrows and placed in a pill-box were all dead after less than twenty-four hours. Both sexes appear to be nearly equally represented: of fifty-six specimens, twenty-five were males and thirty-one females.

Although quite abundant the beetles are by no means easily found. The best way is to carefully inspect a patch of huckleberry bushes in places indicated above, and if there are dead plants or plants with wilted leaves they are sure to be infested by the insect. No attempt should be made to pull out such plants for they break off invariably just at the top of the infested portion, and it is then usually very difficult to find, among the tangle of other roots, the underground continuation of the plant containing the burrows and the beetles. The earth should be carefully removed from the suspected plants, and the infested part of the root will at once be recognizable from some yellow sawdust adhering to it.

From the observation made thus far but little can be said regarding the annual life-cycle of this species. The perfect beetles hybernate either in the larval cradles or in special hybernating galleries. Among the many specimens I found during October there were only two larvæ and three pupæ, and these would no doubt have changed to imagos before the beginning of the winter. In early spring the beetles will no doubt emerge from the plants, copulation taking place outside of the burrows because there is no room therefor within. The female beetle will then bore into fresh plants and commence to lay one egg in each of the larval cradles excavated by herself. If the plant is thin only three or four cradles are excavated, and the beetle probably attacks a second or even a third plant.

In larger plants more cradles are usually made, and the largest number I found in a single plant was fifteen, but it is of course impossible to say whether this corresponds with the largest number of eggs which a single female is capable of laying. The beetle dies within its galleries, and her dead body can still be found when the next generation of beetles has undergone their transformation. Whether there is one or two annual generations can only be determined by future observations.

That this insect is a formidable enemy to the Sugar Maple is evident from Dr. Merriam's account. He says "in Lewis county [N. Y.] alone hundreds of thousands of young sugar maples perished from the ravages of this Scolytid during the summer of 1882." As to its injury to the Huckleberry but little observation is necessary to find that every gallery is fatal to the plant above the infested place. In view of its abundance the beetle would seem, therefore, to act as a serious check to the growth of the plant, but the latter is so exceedingly common and the vitality of the root so indestructible as to fully counterbalance the loss suffered. For while digging in the ground and examining every stock it will be found that the root itself is never killed by the work of the beetle; the plant above the ground dies but the root below the infested part sends forth one or two new shoots.

Supposing that *Corthylus punctatissimus* has no other food-plants besides the Sugar Maple and the Huckleberry, the question arises which of the two is its original food-plant and which represents an acquired habit? A satisfactory answer cannot be given as long as we are ignorant of the food-habits of the beetle in the more southern localities, and more especially whether or not it feeds on the Sugar Maple in South Carolina and further south. The great damage to Sugar Maples in northeastern New York, as reported by Dr. Merriam, has every appearance of resulting from one of those sudden invasions or irruptions which we are accustomed to see in recently introduced insects. Had this beetle been living in the Sugar Maples of New York for many years, its ravages could hardly have failed to attract the attention of the resident entomologists. The species is evidently an immigrant from the south; it belongs to a genus of tropical origin. Five species have been described from South America; others will no doubt be found in the Antillean region; and one, presently to be described, occurs in semi-tropical Florida. *C. punctatissimus* is the only one which extends into the boreal region of North America, and I fully believe that the food-plant

which enabled it to reach the Sugar Maple district of New York is the common Huckleberry.

Upon careful comparison I fail to find the slightest difference between specimens breeding in Huckleberry and others sent by Dr. Merriam, but I take this opportunity to describe another species of *Corthylus* which occurs within the political boundaries of the United States, but which evidently belongs to the colony of West Indian species in southern Florida.

Corthylus spinifer n. sp.—Form oblong, robust; color piceous or reddish-brown; legs and antennæ pale-reddish. Eyes large, transverse, deeply emarginate in front, antennæ inserted in front of the emargination. Thorax and elytra glabrous excepting a few hairs on the front margin of the former. Thorax slightly longer at middle than wide, anteriorly much rounded; sides parallel when viewed from above; basal marginal line well marked and forming an obtuse angle with the lateral line, which nearly reaches the front margin; asperities smaller than in *C. punctatissimus* and indistinctly arranged in concentric rows; posterior half of thorax smooth and tolerably shining. Scutellum semicircular, smooth. Elytra barely as wide as and but little longer than the thorax, cylindrical, broadly rounded at tip, surface shining, finely and rather sparsely punctulate, the punctures irregular except on the disc, where they are distinctly seriate; declivity nearly vertical, slightly retuse, irregularly punctulate, on each side with a longitudinal series of three small cusps, and margined on each side at its apical third by a rather well-defined smooth ridge; suture elevated on the declivity; sutural space not perceptibly excavated and densely punctured. Front tibiæ nearly linear, straight, outer edge finely serrulate and with two larger teeth near the tip, terminal uncus rather blunt and curving outwardly. Abdomen rather densely punctured and hairy. Length, 2 mm.

Male: Surface of head flattened and depressed, the depression rather deep in front, gradually shallowing posteriorly and covered with rather dense yellowish, but not very long, pubescence, sculpture concealed by the pubescence on the anterior part of the depression, posterior portion moderately shining and finely punctulate. Antennal scape greatly dilated toward the tip, triangular, apical edge straight; funicular joint very small, transverse; club very large, nearly circular in outline, densely punctulate and hairy and with three distinct sutures, of which the basal one is nearly straight but distinctly angulated near the anterior end, the two outer sutures decidedly, almost semicircularly, arched; from the base of the inner surface of the club arises a slender spine which, following at first the curvature of the posterior edge of the club, projects above the club and curves inwardly, the projecting portion of the spine being as long as or longer than the whole antenna. If the antennæ are applied to the sides of the head the tips of the two spines overlap each other.

Female: Unknown.

Described from two specimens found by myself on April 19th, in the semi-tropical hammock of the island of Key West, Fla.; precise food-plant unknown.

In the female of *C. punctatissimus* the antennal scape is much more slender than in the male, not dilated, and with the terminal edge rounded; the club is smaller, longer than wide, and more regularly oval. The female of *C. spinifer* will presumably participate in these characters, and further differ from the male in the sculpture and vestiture of the head and in the absence of the antennal spine. Aside from the difference in size and sculpture the two species of *Corthylus* may be distinguished as follows:

Elytral declivity simple; antennal club with two straight sutures, and unarmed in both sexes...*punctatissimus*

Elytral declivity retuse, margined at apical third, and provided each side with three small tubercles; antennal club with three sutures (the two outer ones curved), and armed, in the male, with a long, curved spine ....*spinifer*

Mr. Marlatt presented the following paper:

THE FINAL MOLTING OF TENTHREDINID LARVÆ.

By C. L. Marlatt.

In my experience in rearing the larvæ of various Saw-flies, I have been repeatedly struck with the surprising and apparently anomalous change, just before spinning up or entering the ground to pupate, in coloration only in the case of the smooth-bodied forms, and with spiny larvæ in the loss of the spines, accompanied with similar colorational changes. The variation of larvæ in this particular was so marked that it was difficult to believe that one was dealing with the same species. The lárvæ of totally distinct species could not present more decided differences.

At first the nature of this change was not comprehended, but later it was found that after full growth is reached and the usual four moltings are undergone, what I have termed the final molting takes place. This molting is as complete as any of the others—the entire skin being shed, including that of the head and thoracic feet—and I believe has no counterpart in any other family of insects. In Lepidoptera the hairs in many species, or fleshy appendages, as in certain of the

Cochliopodæ, are shed, and a decided change in color is the general rule, but no true molting occurs.

In general, after this molt the larvæ of different species of Saw-flies become strikingly alike in coloration, assuming a dull greenish or slate color on the dorsum and sides and yellowish below the stigmata and bordering the anterior margin of the first segment. The shining black head of some Saw-flies, as, for instance, *Monophadnus bardus* Say, after this molt, becomes in general whitish, with a smoky shade above; the black thoracic feet also become light.

This molt is not accompanied, as in the earlier ones, with an increase in the size of the head, and after it the larva does not feed, but wanders about in search of a suitable place to form its cocoon.

The loss of spines and tubercles has been noted particularly in the case of the Raspberry Saw-fly, *Monophadnus rubi* Harris and allied spiny larvæ feeding on the ash and oak, the loss of efflorescence in *Harpiphorus varianus* Nort., and the alteration in color in the species mentioned and a considerable number of additional species.

The first reference to this feature in the history of Saw-fly larvæ in American writings on Tenthredinidæ occurs, I believe, in an account of the Ash Saw-fly (*Monophadnus bardus* Say) by Prof. Popenoe and the writer, in the annual report of the Kansas Experiment Station for 1888.

Mr. J. G. Jack also notes this feature in his recent account of the Dogwood Saw-fly (*Harpiphorus varianus* Norton) in *Garden and Forest* (Vol. II, p. 520).

A somewhat extensive examination of European works on Tenthredinidæ leads to the belief that this final molting has been generally overlooked. As an illustration of this, André, in his very valuable and complete Monograph of the Tenthredinidæ of Europe and Algiers, certainly does not refer to it.

Cameron, however, in his Monograph of the British Phytophagous Hymenoptera, states that such change is undergone by most Tenthredinid larvæ, and that with certain species the larvæ become brighter colored rather than duller and less conspicuously marked. I have not observed this latter to be the case in any of our American species, and the assumption of a more showy coloration is certainly the exception. His explanation of this molt, with accompanying change in appearance, is on the ground of protection, which he argues is especially needed during the period in which the larvæ, after abandoning their food-plant or galls, are wandering about before entering the ground or otherwise concealing themselves. The dull coloring protects the edible forms from enemies by rendering

them less conspicuous, and those that become more brightly colored—and these are, he says, commonly protected from insectivorous animals by the power which they possess of ejecting acid or otherwise distasteful fluids—are protected by becoming more noticeable, and hence less liable to be mistaken for edible species.

I cannot believe that this explanation is the true one, as this shedding of the skin affords but slight protection, if any; and after this molt, which, in fact, frequently does not occur until after the food-plant has been abandoned, the larva immediately conceals itself either in earth, rotten wood, rubbish, etc., or spins up, so that protection from enemies is entirely unnecessary.

Most Saw-fly larvæ, also, are gregarious in habit, including those in which this change is most marked, and from this fact and their manner of feeding are very conspicuous throughout their larval life, and are therefore of particularly easy access to their parasitic and other enemies. For these reasons, I am convinced that this molt has no protective significance, but has its explanation in the fact that generally Tenthredinid larvæ remain for a long period in a dormant-larval or pseudo-pupal state—most of them being single-brooded. This molt is analogous, then, to the one before pupation proper in insects, which in Tenthredinidæ is commonly undergone a few days only before the emergence of the mature insect.

The contraction of Saw-fly larvæ in the ultimate larval or pseudo-pupal state is very marked, and the close approach to the pupa is shown in the case of some species by the eyes of the adult insect appearing as oval dusky spots on the larval head.

These larvæ, then, undergo a supplemental molt preparatory to the long larval hibernation, and the contracted dormant larva during this period corresponds in a sense to the pupal or resting stage of most insects, which is always preceded by a shedding of the larval skin.

Mr. Townsend read the following paper:

NOTE ON THE GENERA TRIPTOTRICHA LW. AND AGNOTOMYIA WILL.

By C. H. Tyler Townsend.

The Leptid genus *Agnotomyia* was described in 1886 by Dr. Williston (Ent. Am., II, 106) for a fly formerly placed in the

genus *Lomatia* (*Stygia*) in the *Bombyliidæ*, and which is now known as *Agnotomyia elongata* Say. This species was for a long time an enigma to dipterologists. The genus is closely related to *Triptotricha*, from which it is described as differing in having only one spur on the front tibiæ, only four posterior cells in the wings, and the last posterior vein arising from the discal cell. In the above paper Dr. Williston calls attention to the fact observed by Lœw that specimens of *T. fasciventris* often occur in which there is an abbreviation of the third posterior vein, and adds that he has observed also that rarely the last posterior vein arises from near the base of the discal cell. Supposing the bare possibility of a *Triptotricha* with the neuration of *Agnotomyia*, he notes that the two spurs on the front tibiæ would serve to distinguish the former, and says that in the three species of *Triptotricha* known to him all the tibiæ have two spurs. It will be seen that Dr. Williston had not at that time critically examined *T. rufithorax* Say, which has only one spur on the front tibiæ. I have found that in this species also the third posterior vein is often abbreviated, while in two instances I have seen the last posterior vein arising from the discal cell, being well removed from the second basal. It is frequently the case that this vein (last posterior) is continuous with the cross-vein that separates the discal and second basal cells. Twenty-four specimens of *rufithorax* that I have examined possess at least an abbreviation of the third posterior vein. One of this species collected near Rock Creek, D. C., June 15, is peculiar for possessing an extra cross-vein in the left wing, which cuts off the outer one-eighth of the first basal cell, and is parallel with the small cross-vein of the wing.

The three species of *Triptotricha* above referred to by Dr. Williston as having two spurs on all the tibiæ I infer to be *fasciventris*, *discolor* and *lauta*—all Lœw's species. I have seen the last species, and it possesses two front tibial spurs. Lœw, in his description of *lauta*, either overlooked the two spurs or, what is more likely, believed Say's *rufithorax* to also possess two, for he mentions the points of difference between the two without noticing this distinction. The genus *Triptotricha* must be accepted, in the strict sense, as including the three forms which Lœw described, for which he erected his genus, and all of which possess two front tibial spurs. Say's species falls in another natural division as it has only one front tibial spur. I have seen also a single ♀ of an undescribed species from the Pacific coast which has only one front tibial spur, and differs from *rufithorax* chiefly in its larger head. These constitute a separate group, but as there are yet only a few species to be located here, and as these two groups do not

seem otherwise to differ in structure, it would be premature to accord them generic separation. The character of the single front tibial spur should not of itself, I believe, be entitled to generic value.

From the data above given it will be seen that the genus *Agnotomyia* stands chiefly on neurational characters, which are not very constant in this group. It is wholly unlikely, however, that an aberrant *Triptotricha* will ever be found to exhibit the neuration of *Agnotomyia;* but should such a case occur, comparison with typical specimens will be necessary to distinguish it.

I may add that Dr. E. Bergroth has pointed out that Lœw's genus *Triptotricha* is a synonym of *Dialysis* Walker (Wien. Ent. Zeit., VIII, 296). In the same paper Dr. Bergroth has given a synopsis of the species, the two sexes being tabulated separately, and has described *D. disparilis* n. sp. ♂ ♀ from Vancouver Island.

Mr. Schwarz asked if anything was known of the habits and early stages of these Diptera. Mr. Townsend replied that he knew nothing of the habits and early stages except the statement made by Dr. Williston that the larvæ live in decaying leaves. The adults occur on low vegetation in woods.

Mr. Fernow called attention to the ravages of *Psilura monacha* in the pine and spruce forests of Germany, particularly in Bavaria.

DECEMBER 4TH, 1890.

Fourteen persons present. President Marx in the chair.

The following paper, by Mr. P. R. Uhler, was read by the Corresponding Secretary:

OBSERVATIONS ON SOME REMARKABLE FORMS OF CAPSIDÆ.

BY P. R. UHLER.

Heidemannia. New genus.

Form elliptical, resembling *Salda* in contour, nearly flat above. Head exceptionally small, projecting above the pronotum, appearing hemi-

spherical from above; eyes unusually large, enclosing the sides of the head, feebly convex, not prominent; vertex triangular, narrowed towards the base, at which point the carina is distinctly elevated; face oblong, curving backwards beneath, convex on the transverse diameter; lower division of front triangular above, sub-conical below, with the tylus small and narrow. Antennæ attached beneath the inner angle of the eyes, the basal joint very short, thick, but not as stout as the second joint, the second gradually thickened towards the tip, as long as the vertex and pronotum united, the third and fourth very slender, conjointly not as long as the second, the third longer than the fourth, and the fourth subfusiform, acute at tip. Rostrum reaching almost to the tip of

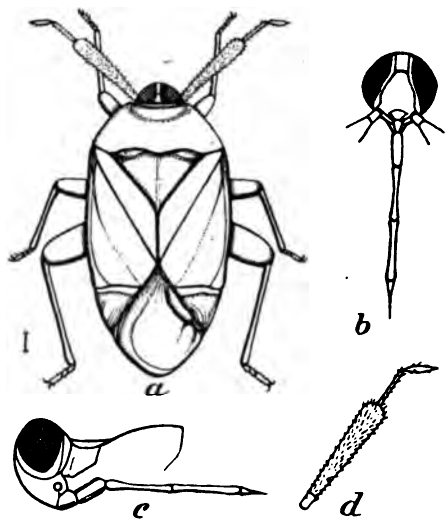

FIG. 7.—*Heidemannia cixiiformis* Uhler: *a*, female; *b*, front view of head; *c*, side view of head; *d*, antenna (original).

the venter, the third joint compressed, fourth joint acute. Anterior sinuated border of prosternum raised into a high collar; mesosternum with a tumid prominence. Pronotum transverse, depressed each side, with the lateral margins oblique and recurved, almost concurrent with the sides of the head; the anterior margin arcuated, posterior margin sinuated on the middle, with the humeral border oblique. Scutellum large and flat, wider at base than the sinus of the pronotal margin. Hemelytra flat, thick, opaque, of nearly sub-equal width from inner angle of clavus to base of membrane, costal margin feebly curved, broadly reflexed, with a long embolium beneath; cuneus large, well separated from the corium, scarcely incised, forming a continuous oblique line with the

apical border of the corium ; membrane blunt, sub-trapezoidal, with the inner angle moderately acute. Legs short, anterior femora wide, and moderately compressed.

The loral pieces are so obscure in the specimen studied that I cannot now describe their forms.

H. cixiiformis. New species.

Dull black, finely sericeo-pubescent, with a narrow white band across the base of the cuneus, the upper surface minutely scabrous and punctate, very sparsely punctate on middle of hemelytra. Head convex, somewhat grayish above, marked with a pale triangle on upper part of face, followed beneath by pale rufo-piceous to the base of rostrum. Rostrum and sternum piceous. Antennæ black, with the two apical joints pale fuscous. Venter red or piceous. Membrane pale, tinged with fuscous.

Length to tip of hemelytra, 2¼–2½ millims. Width of base of pronotum, 1 millimetre.

Only three specimens of this remarkable insect have yet been discovered. One of them was captured near Washington, on the 15th of June, by Mr. Heidemann ; a second was taken at Oakland, Md., July 12, and the third one was secured near Fort Pendleton, W. Va., July 10, in the wooded district adjacent to the fork of the great branches of the Potomac river.

Other specimens are needed for dissection to work out the elements and affinities of this antique pattern of the *Capsidæ*. It is remarkable for having the head pressed back upon the sternum, as in the Homoptera, and its general figure distinctly recalls the form which prevails so commonly in many of the *Cixiidæ*.

Peritropis. New genus.

Ovate or sub-elliptical, acute in front. Head oblique, contracted and conical in front of the eyes ; eyes large, oval, nearly vertical, as long as the thickness of the head, prominent, but not strongly projecting above the vertex ; vertex moderately convex, having an impressed line in the middle, which is continuous with that upon the pronotum ; face sub-cylindrical, the tylus prominent, extending up to the level of the antennæ ; upper gena broad and short, inferior cheeks narrow ; antennæ nearly as long as the head, pronotum and scutellum united, the basal joint thickest, cylindrical, about as long as the face to tip of tylus, second joint stout, as long as the head and pronotum united, third and fourth abruptly slender and very short ; rostrum slender, reaching to behind middle of venter, the basal joint barely shorter than the throat. Pro-

notum transverse, strongly sloping towards the head, almost flat, shield-like, with the callosities proximate, central, and abruptly tumid; the lateral margins oblique, reflexed, the posterior margin broadly sinuate, undulate, and trituberculate, the middle tubercle linear, humeral angles oblique and blunt. Scutellum large, sub-equilateral, convex near the base, basal lobe widely exposed. Mesosternum deeply sunken. Legs short, the femora stout, compressed, subfusiform, and the tibiæ very slender. Hemelytra thick, opaque, with the veins strongly defined, the corium wide behind the middle, curved and reflexed on the costal border, posterior margin almost concurrently oblique with the cuneus, the cuneus small, triangular, feebly incised at base, slightly curved on the basal margin, embolium long, broad and flattened. Membrane large, broadly rounded at tip, the basal cell very large. Female more elongated than the male.

P. saldæformis. New species.

Ovate, broad, blackish-fuscous, or very dark brown, opaque. Head from above almost sharp-pointed, brownish-yellow, marked with fuscous behind and on the sides, the throat piceous. Antennæ blackish-brown, paler on the first joint and base of second, the two apical joints pale brownish; eyes blackish; rostrum pale piceous, or dull testaceous. Pronotum brownish-yellow, with an angular black spot each side of the callosities, anteriorly, and a smaller spot on the indentation between them, the surface rugose and pointed with fine black dots, especially on the outer reflexed margins, the posterior margin with three white, small tubercles. Scutellum moderately rugose, and with a feebly raised, short line each side next the basal angles, the apex minutely testaceous. Sternum blackish, pale along the middle and on the outer margin, sometimes with a large testaceous band which includes all of the coxæ. Hemelytra dull blackish-brown, very sparsely pubescent, the costal edge sharp, interrupted with small white dots, the adjoining border broadly depressed throughout, base of the cuneus and some faint lines on the border next the membrane pale, embolium dull brownish-yellow, margined exteriorly with black, which is interrupted by minute pale flecks. Membrane blackish-fuliginous. Legs piceous-blackish, the femora paler at either end, the tibiæ twice-banded with testaceous; tarsi more or less testaceous.

Length to tip of hemelytra, 2¾-3 millims; width at base of pronotum, 1-1¼ millims.

Five adults and two nymphs have been examined; but of the former all have been too shriveled to permit exhaustive examination. The males are broader than the females, and more brightly colored.

Specimens were submitted to me for examination by Mr. O. Heidemann, which he obtained from dried branches of trees in

the region near Washington, July 20 to 28. Others have been captured near Chicago and in other parts of northern Illinois.

NOTE ON CYLAPUS TENUICORNIS SAY.

The recent discovery of *Cylapus tenuicornis* Say, by Mr. Otto Heidemann, in the neighborhood of Washington, recovers for entomological science one of the long-lost genera and species of Say's work upon the Hemiptera. This form is of peculiar interest at the present time, since it forms the only member of this division which has thus far been found in the United States. Upon close comparison with Stål's description of his *Valdasus famularis* and with the figure of the same given by Mr. Distant in the Biologia Centrali-Americana, plate 24, figure 7, we perceive that they refer to this insect, and consequently that the later names, both generic and specific, employed by these authors must give way to those of Mr. Say. The species is now seen to have a wide range of distribution. Dr. Stål's specimens were captured in Mexico; Mr. Say's types were found near New Harmony, Ind.; and, latest of all, Mr. Heidemann discovered numerous individuals at Bladensburg, in August and September, upon fungi attached to dried bark of trees. This species proves to be very variable, both in color and structure. The males, as usual, have the eyes more prominent than the females, although one specimen of the female has those organs more widely separated from the pronotum than in any male yet examined. In no specimen yet studied is there a contact of the eyes with the pronotum.

Mr. Howard read the following:

THE PARASITES OF THE HEMEROBIINÆ.

By L. O. HOWARD.

The insects of this group are singularly well protected against the attacks of natural enemies, the adults by their offensive odor, the pupæ by their strong cocoon, the larvæ of some by their coating of aphidid skins and of others by their own strength, ferocity and agility, while the eggs are safely mounted at the tip of long foot-stalks. They do not, however, lack their characteristic hymenopterous parasites. In Europe four primary parasites are known, viz: *Microgaster ater*, *He-*

lorus ater, *Anacharis ensifer*, and *Ephialtes gracilis*. The first three have been reared by Brischke from undetermined species of *Chrysopa*, and the last by Ratzeburg from an undetermined species of *Hemerobius*. Of secondary parasites five species of *Hemiteles*, *H. castaneus*, *H. areator*, *H. limbatus*, *H. æstivalis*, *H.* sp., have been reared by Brischke, Giraud and Ratzeburg from cocoons of either *Chrysopa* or *Hemerobius*.

In this country we have an egg-parasite of either *Chrysopa* or *Hemerobius*. I exhibited specimens of this—an exceedingly minute *Telenomus*—at the first meeting of this Society, April 3, 1884. Three secondary parasites have also been reared from larva or cocoon by Prof. Riley. These are *Hemiteles hemerobiicola* Ashm., *H. rufiventris* Riley MS., and *Mesochorus* (?) *chrysopæ* Ashm. Precisely what their primary parasites are in America, however, has not been previously known, although it is fair to suppose that our species of the abnormal proctotrupid genus *Helorus* (of which we have several) will be ultimately found to have this habit. The recent unpublished notes of the Division of Entomology, however, indicate that we have one most interesting and widespread primary parasite in *Isodromus iceryæ* M., originally described (without doubt erroneously) as a parasite of *Icerya purchasi*. This handsome little Chalcidid has been reared since 1887 from Chrysopa cocoons received from Los Angeles, Cal., from Kirkwood, Mo., and from Umatilla, Fla., as well as from others found upon the grounds of the Department of Agriculture at Washington. Moreover, I am rather of the opinion that this is the insect illustrated by Glover at figure 45, plate III, of his report for 1877, and concerning which he says (p. 99):

"*Aphelinus* is a small parasitic fly, which was found destroying *Chrysopa*, a neuropterous insect, which was bred in Maryland and formed a cocoon on a small shrub."

The figure could not have been drawn from a true *Aphelinus*, but it is quite possible, from structural detail and general appearance, that Glover had *Isodromus* before him. I described this latter genus in the Annual Report of the Department of Agriculture for 1886 (p. 488), and the type is illustrated at figure 1, plate III, of the same report.

Mr. Schwarz remarked that in consequence of the extraordinary abundance of Aphids during the past spring and early summer, the larvæ of Chrysopa and various Coccinellids were likewise unusually numerous on the trees in the Smithsonian grounds. On one Linden tree the supply of Aphids gave out,

and he had seen the larva of *Anatis 15-punctata* attack and feed upon a *Chrysopa* larva. Cocoons of the latter genus were also found which had evidently been eaten into by some insect, and he suspected that this was also the work of *Anatis*.

Mr. Howard said that at Toronto he had been bitten, to his surprise, by the larva of Chrysopa, and had noted with considerable curiosity the peculiar action of the insect in pumping up the blood.

Mr. Marlatt presented a note in which he proposed the specific name *unicolor* for a species of *Monoctenus*, the larvæ of which feed on the Red Cedar, *Juniperus virginiana*. This Saw-fly had been described by him in the Transactions of the Kansas Academy of Science, Vol. X, page 82, as *M. juniperi*, but this name had long since been applied to a European species of the genus by Linnæus.

Mr. Banks presented the following paper:

ON THALAMIA PARIETALIS HENTZ.

By Nathan Banks.

The subject of this paper is a small spider, two millimeters long, two specimens of which [♂ and ♀] I found in the corners of my room while in Texas last September.

Thalamia parietalis was described by Hentz in Proc. Bost. Soc. Nat. Hist., in 1850, along with his other spiders. The spider seemed so peculiar to him, that for it he erected the genus *Thalamia*, and placed it between *Mimetus* and *Scytodes*, two genera which he placed in the *Theridiidæ*. The spider has not been recorded since Hentz's time. Hentz gave as the characters of the genus *Thalamia*, which by the way he called a subgenus, the following: "Eyes 8, subequal, in two rows on each side of the front part of the cephalothorax, each row strongly curved inward above and outward below; maxillæ wider at base, inclined over the lip; cheliceres very small, feet 2. 3. 4. 1." Hentz further states that the spider forms a tubular dwelling of silk in the crevices of walls, protected from the sun and rain. He believed it had some affinity with *Theridion*. The species *parietalis* is characterized as follows: "Obscure; cephalothorax pale with a bifurcated blackish line, abdomen with several dusky small spots; feet slender, 2. 3. 4. 1." Locality, South Alabama.

My specimens agree with Hentz's description and figure, except that Hentz figures the posterior median eyes as round; whereas in my specimens they are peculiarly elongate and curved. Still I do not doubt that this is the species referred to by Hentz.

On examining the spider one is immediately struck not only by its general peculiar appearance, but more especially by several strange structures. The cephalothorax is somewhat circular and quite low. The posterior lateral eyes are large, those of the lower row much smaller. The posterior median eyes are close to the posterior lateral, and are elongate, curved, and somewhat pointed behind; they project but slightly above the surface of the head. The mandibles are small, and are partially united at the base. The lip triangular and the maxillæ surround it. The principal other peculiar features are at the opposite end of the animal: these are the spinnerets and some hairs surrounding the anus. The spinnerets are six in number; the superior pair is two-jointed, the distal joint much the longer and somewhat curved; they project quite a little beyond the tip of the abdomen, and are seen in Hentz's figure. Between these spinnerets the abdomen is raised into a slight cone; near the top of this cone, and almost surrounding it, is a row of hairs which are strongly bent near their middle and enlarged slightly at their tip. The four other spinnerets are short; near their base is apparently a somewhat simple cribellum, but I can see no calamistrum on the hind metatarsi, so do not feel sure that it is a cribellum. I can find but two claws to the tarsi; these have about six teeth. They appear somewhat separate from the tarsus and may, perhaps, be considered as forming a claw-joint, as is found in the *Pholcidæ* and other allied forms.

From a study of the figure and description by Hentz, Dr. Marx in his catalogue has placed it in the family *Urocteidæ*. The eyes are apparently the same as in *Œcobius*. But, as I have said, I can find but two tarsal claws, while the *Urocteidæ* have three; neither does this family have a cribellum, which *Thalamia* apparently possesses. Blackwall described a species of *Œcobius*, *Œ. navus*, as having two tarsal claws and cribellum and calamistrum. Thorell throws this out of the family *Urocteidæ* on the above characters, and erects for the species a separate family, the *Omanoidæ*, and changes the name of Blackwall's spider to *Omanus navus*. *Thalamia* would seem to be related to this spider.

But in my short study of *Thalamia* I have come to other conclusions as regards its position, as well as the position of other spiders more or less closely related to it. Dugès in 1863

united *Scytodes*, *Pholcus*, *Uroctea*, *Hersilia*, *Enyo* and *Filistata* into one group, the *Micrognathes*, on account of their small mandibles. Thorell, though holding a separate family for each of these genera except *Pholcus*, which he places in the *Scytodoidæ*, admits that they are closely related to each other, not only by the structure of their mandibles but also by the similarity in the shape of their maxillæ, these being curved around the lip. In speaking of the subject, Thorell says: "These genera (*Enyo*, *Uroctea* and *Filistata*) in fact show no small affinity with the *Scytodoidæ*."

I have had no specimens of either *Enyo* or *Hersilia* to study, but in studying *Thalamia* in connection with the *Pholcidæ*, *Scytodidæ* and *Filistatidæ* I have come to the conclusion that their relation is a close and important one. Of such importance that they should be united in one group of family rank, and for this family—embracing the *Filistatidæ*, the *Pholcidæ*, the *Scytodidæ*, the *Urocteidæ*, the *Enyoidæ* and the *Hersilidæ*—I propose Dugès's name *Micrognathes*, now changed to the form *Micrognathidæ*.

I can divine no reason why *Filistata* should be separated from *Pholcus*. There certainly is no vital difference between them. Different as is their general aspect, they are remarkably alike in structure. *Thalamia*, though differing from *Filistata* in the spinnerets, shows plainly by the great similarity of cephalic structure that *Filistata* is one of its nearest relatives. *Scytodes* and *Loxosceles* are very closely related to *Filistata* in that the lip is joined to the sternum; also in palpal structure are they related. Thorell says that the *Enyoidæ* have eyes like the *Urocteidæ*. This family is also very closely related to *Scytodidæ*. The *Pholcidæ*, *Enyoidæ* and *Hersilidæ* all have an extra claw-joint, which certainly marks their relationship.

There are scarcely any of the *Micrognathidæ* but what possess some peculiar structure. The *Scytodidæ* have but six eyes, arranged in three groups; *Loxosceles*, one of the genera of *Scytodidæ*, has a conical spine between the lower spinnerets. *Pholcus* has an extra joint to its long legs, and Thorell says of *P. pullulus* Hentz, that the tarsi are divided up into ten to twelve joints. *Thalamia* and *Œcobius* have a circle of peculiar spines around the tip of the abdomen, while the posterior median eyes are also peculiar.

Yet many peculiar structures are possessed by a number of these genera, forming such a network of relationship that I think it impossible to separate them in distinct families. As I have previously said, they all have small mandibles somewhat united at the base; also the maxillæ surround the lip. There

is a slight variation from this in *Loxosceles*, the maxillæ being more parallel in our species ; yet Thorell says of the European species that "the *Scytodoidæ* [*Pholcus*, *Spermophora*, *Scytodes* and *Loxosceles*] agree with all these genera [*Enyo*, *Uroctea* and *Filistata*] in having the maxillæ closely encircling the lip." The eyes in all the genera are not so much on the front part of the head but more on the dorsal part of it, and situated at a distance from the anterior margin of the cephalothorax. The cephalothorax in some forms projects more or less in front ; this is the case with *Pholcus*, *Thalamia*, *Filistata* and *Loxosceles*. The upper spinnerets are long and two-jointed in *Thalamia*, *Œcobius* and *Uroctea*. The extra claw-joint is present in *Hersilia*, *Pholcus*, *Spermophora*, *Scytodes*, *Loxosceles*, *Enyo* and *Zodarium*. The cephalothorax is nearly circular or subcordate in all of the forms. In *Filistata* and *Loxosceles* the ♂ palpus is quite embryonic ; in *Scytodes* it is more developed ; in *Pholcus* it is quite complex.

Thus, to sum up, besides the characters of the mouth parts, *Filistata* is related closely to *Loxosceles* in the form of the ♂ palpus, and through *Loxosceles* to *Scytodes*. *Filistata* is related to *Pholcus* in the position of the eyes, and through *Pholcus* to *Spermophora*. It is related to *Thalamia* in the position of the eyes and in the structure of the cephalothorax, and through this genus to *Uroctea* and *Œcobius*. *Pholcus* is related to *Enyo* in the position of the eyes and in the possession of the extra claw-joint, while *Hersilia* is related to both of these genera by the latter character. Thus these genera not only possess certain peculiar characters in common, but they also possess such interrelations, as I believe, require a separate family for their reception. The *Micrognathidæ* may be characterized as follows :

Spiders of low rank ; mandibles small, more or less united at the base ; maxillæ surrounding the lip, which is sometimes united to the sternum ; eyes six to eight ; cephalothorax round or subcordate ; claws two or three ; upper spinnerets frequently long ; claw-joint often present.

Typical genus *Filistata* ; other genera *Scytodes*, *Loxosceles*, *Dictis*, *Pholcus*, *Spermophora*, *Thalamia*, *Œcobius*, *Uroctea*, *Hersilia*, *Hersiliola*, *Enyo*, *Zodarium*, *Storena*, *Ascena*, *Laches*.

In answer to a question by Dr. Fox, Mr. Banks stated that he should describe the eyes of *Thalamia parietalis* as forming two longitudinal rows rather than as four transverse rows.

Prof. Riley read an interesting letter from our fellow-member, Mr. Ashmead, relating to various entomological matters, and describing his [Ashmead's] experiences and work at Berlin, and particularly his first impressions of the enormous extent of the insect collections of the Royal Museum. Prof. Riley remarked that he was particularly pleased at the statement that "The large collections here have had a depressing effect upon me, and I cannot conceive how one little brain can take in all in one order," because it showed that Mr. Ashmead realized the necessity of concentration in order to do the best work.

Prof. Riley also read a letter from an old correspondent, Mr. S. S. Rathvon, of Lancaster, Pa., relating to certain undetermined *Phytonomus* larvæ which occurred on the campus at Lancaster, as well as other matters, and called attention to the clear chirography and diction and the unflagging interest in and knowledge of the entomology of to-day somewhat remarkable in a man over eighty years old, and suffering from various severe bodily ailments.

Prof. Riley then presented the following paper:

A VIVIPAROUS COCKROACH.

By C. V. Riley.

I present to the Society alcoholic specimens of a female cockroach with her young, received recently from Dr. Carl F. Gissler, of Brooklyn, who found it a little more than a year ago in Brooklyn on a cabbage, and informed me, in communicating it, that it had given birth to the young viviparously. I also present enlarged drawings of the female and of the young. The species is *Panchlora viridis*, common in South America, and peculiar as compared with our own cockroaches in being of a light green color. The specimens interested me greatly, because, so far as I have been able to ascertain, there is no record of a viviparous Blattid, and after a careful examination, involving dissection of the abdomen of the specimen, I see no reason whatever to doubt the accuracy of Dr. Gissler's statement. Several of the young had already been born, as stated by him, but still others were in the abdomen readv to

emerge, with no trace of either eggs or egg-case. The significance of this exceptional fact is that the extrusion of the eggs in a compact oötheca is supposed to be one of the distinguishing features of the family *Blattidæ*, and such cases serve to show how difficult it is to lay down any rule in reference to the characteristics of any group that may not involve exceptions. So far as other family characteristics are concerned there is nothing peculiar in this species of *Panchlora*. It is a rather soft-bodied species, with ample wings. I would call attention, however, to the fact that the young have either lost or never had the green color of the parent. They are pale brownish, and are further peculiar in that the body broadens posteriorly, the abdominal joints being strongly contracted and telescoped into each other—the eighth and ninth so strongly drawn into the seventh as to give the abdomen an unnatural, foreshortened, truncated appearance. Whether this feature is due to the alcohol, or is normal, it is impossible to say; but there is no evidence of any other portion of the body having shrunken or contracted on account of the preservative liquid.

Prof. Riley gave an account also of his additional study of *Platypsyllus*. He said that since his former communication he had been particularly anxious to secure other specimens of the ultimate larvæ and also specimens of the pupa of this insect, and had had two or three persons at work in different places with this end in view. In all some twenty Beavers had been examined, and additional larvæ and adults had been secured, but no pupæ. He had, however, been able to add quite a list of insects, etc., which are associated with the Beaver, either accidentally or as parasites or guests. These are: a Mallophagan of peculiar form (*Trichodectes* near *crassus* Drury); four genera of mites; seventeen species of Coleoptera (Staphylinidæ, Histeridæ, Silphidæ and Elateridæ), none of which are supposed to be at all parasitic; a *Julus* and a *Geophilus*; Bibionid and Culicid larvæ; a Cricket; a *Tettix*; three spiders; a Trombidium and a small roach.

Mr. Schwarz asked how the insects associated with the Beaver had been found, many of the forms mentioned being such as would occur in masses of rubbish, dry leaves, etc.

Prof. Riley said that most were taken in the Beaver dens or houses, which always contained a mass of material which might attract the insects in question, and they were sifted either from the material of the nest or the earth underneath it. He said that the dens and nests were commonly connected with the banks of the stream under water, and with the air at some other generally hidden point, thus affording opportunity for the entrance of the insects, or that these might also be introduced with the material used in the construction of the den. With reference to the pupa of *Platypsyllus* he said that he was forced to the opinion that this stage is passed underground, in which belief Mr. Schwarz coincided.

Prof. Riley said, also, that the Mallophagan and the mites were found on the beavers themselves.

Prof. Riley also called attention to the Minutes of the Proceedings of the London Entomological Society for October 1, 1890, as published in the *Entomologist's Monthly Magazine* for November, 1890, and elsewhere. It is there stated that Mr. C. J. Gahan exhibited a "curious little larva-like creature" found in the mountain streams of Ceylon, and that there was a discussion as to what the larva was. From the brief characteristics given by Mr. Gahan it struck Prof. Riley that the larva referred to is that of some species of the Dipterous family *Blepharoceridæ*. He stated that good figures of a South American species, genus *Paltostoma*, have been published by Fritz Mueller, and that he (Prof. Riley) is familiar with the larvæ and pupæ of two North American species and has for many years had drawings of the same, which are not yet published.

He also called attention to an article in *Entomological News* for October last, in which, under the head of "What can it be?" Mrs. Julia P. Ballard, of Easton, Pa., describes a larva which has puzzled her because, while having some of the characteristics of *Citheronia regalis*, with which she is quite familiar, it nevertheless materially differs from that species. Her description leaves no doubt that the larva which so puzzled her was that of the only other congener, namely, *Citheronia sepulchralis*. This larva is not uncommon in the vicinity of Washington and along the lower Potomac, where it feeds

on *Pinus inops* and *P. tæda;* and fine blown and alcoholic specimens are in the Museum, collected by Mr. Koebele.

Prof. Riley then presented the following:

ON THE TIME OF TRANSFORMATION IN THE GENUS LACHNOSTERNA.

By C. V. Riley.

At the late meeting of the Association of Economic Entomologists, at Champaign, one of the most interesting papers read was that by Prof. S. A. Forbes on the larvæ of *Lachnosterna*—the paper being a summary of several years' study of the larvæ of different species. Prof. Forbes had found certain satisfactory larval characteristics that permit the distinguishing of the different species in the arrangement and character of the stiff hairs on the underside of the anal segment. This fact will prove of great value to us, for it has always been extremely difficult to refer any particular Lachnosterna larva to its species. I have heretofore endeavored to do so by the characters of the head and trophi, but have never felt great confidence when it came to closely-allied species. How generally applicable the distinguishing features recorded by Prof. Forbes will prove to be experience alone will determine; but his studies cover several well-known species that occur in Illinois. The feature, however, of Prof. Forbes's paper which I wish more particularly to call attention to relates to the time of year when transformation takes place in this genus. From recent experiments, Prof. Forbes is inclined to believe that the history of the White Grub, as given by authors, is a comedy of errors, and that the transformation invariably takes place in late summer or early autumn. The fact that transformation in some species, notably *fusca*, takes place normally in the fall has been quite generally known, at least to the members of this Society, and was brought out in a discussion of Mr. Smith's paper, presented before the Society at its October (1888) meeting, in which he showed the value of the genitalia in determining the different species. In my earlier writings on *fusca*, notably in the first Report on the insects of Missouri, (1868), I mentioned the spring transformation as the normal and the fall transformation as the exceptional, having up to that time had more occasion to obtain the insect in spring, with the turning up of the ground, than in the fall. In later articles (notably in the New York Semi-Weekly Tribune of November 12, 1875) I

drew more attention to the fall transformation, and for many years have been convinced that, so far as the latitudes of St. Louis and Washington are concerned, this last is the more common. Prof. Forbes himself, in 1883, followed closely my statement in 1868. In looking up my MS. notes, however, I find positive evidence that fall transformation is not the uniform habit, as Prof. Forbes's conclusions would lead one to suppose; because what has been taken for *fusca* has sometimes been found in the spring, and in one instance the full-grown larva of what was in one case *fusca* and in the other either *fusca* or *ephelida*, was found and pupated in spring. Considering all the facts, I am inclined to believe that those species which appear early in summer transform, as a rule, the previous autumn, such for instance as *arcuata*, *hirticula*, *fraterna* and *tristis*. These have all been found in the imago state at Washington in the fall or winter, and Mr. Schwarz tells me that the same is true of *dubia* and *hirticula* in Michigan. The later-appearing species, *i. e.*, *gracilis*, *gibbosa* and *crenulata*, are not found as beetles in the ground in the fall, the legitimate inference being that they transform as a rule in spring. According to Mr. Schwarz's experience some of the early appearing species, viz: *inversa* and *micans*, which are quite common in Washington, have not yet been found in the fall, and, so far as the negative fact goes, it would militate against this generalization and indicate that in these instances the transformation is vernal. Of the undetermined larvæ, a certain number collected near Washington in the fall of 1888, all of the same size, remained untransformed during the winter—one having changed to pupa in May and the others having died during the spring.

Prof. Forbes records in his paper having found pupæ or larvæ beginning to pupate in the month of June, the species, if I recollect rightly, being *inversa*, which is one of those which appear early with us; but such early pupation, if of a late-appearing species, would not necessarily argue that the imagos would remain inactive until the following year, but might apply to late-appearing species, such as *gibbosa* and *ephelida*, which are recorded in the latitude of Washington as late as August. In fact, a well advanced pupa of what is without doubt the latter species (it is a ♂, and shows the characteristic tibial spur) is in the collection taken in August. The records, as published by Smith, show that *ephelida* occurs in July and August, being our latest species, and it is safer to assume that the imago from this pupa would have issued and paired the same season, than that the imago would have remained practically inactive till the subsequent July. The

whole question is interesting and somewhat involved, on account of the length of time covered by the appearance of the different species, and while I felt impressed, on hearing the paper, with the fact that a great deal of excellent original work had been done at Champaign, and that the statements in the current literature (which is so largely unacknowledged compilation) would be effectually modified thereby, yet the authoritative statements, which have been based on observation, have not been materially impugned.

Further investigation will doubtless show that the fall or spring transformation is dependent to some extent upon latitude, and that, on this account, great irregularity may be looked for. There is here a rich field for careful study and experiment in different parts of the country, and it may turn out that the three-year period, which is pretty fully substantiated for the full life-cycle of some of the commoner forms, may be either shortened or lengthened according to latitude or species.

In this connection I would also put on record the fact that, according to Mr. Webster, from whom specimens have been received as having been obtained from Lachnosterna larvæ, an undescribed Tachinid and *Ophion bifoveolatum* may be added to the list of parasites which I have already recorded as attacking the larva of *fusca*.

Mr. Townsend presented the following paper:

NOTES ON NORTH AMERICAN TACHINIDÆ SENS. LAT., WITH DESCRIPTIONS OF NEW SPECIES.

PAPER I.

By C. H. Tyler Townsend.

In the first families of the *Tachinidæ s. lat.* much confusion has resulted from the descriptions of the earlier authors, due in great part to the fact that the two sexes of these flies exhibit marked differences, which would lead one to consider them distinct species. From a critical study of descriptions and material I have collected a considerable number of notes, synonymical, relating to distribution, etc., which I here present, together with descriptions of some new species.

Phasia atripennis Say. This is not a *Phasia*. The description shows that the apical cell is petiolate, and compares the venation to that of *Phasia semicinerea* Meig., which however

is an *Alophora* sens. Schiner, of the sub-genus *Hyalomyia.** Meigen's figure misled Say. This species probably does not belong in the *Phasiidæ* at all. I am inclined to refer it to the genus *Wahlbergia* in the *Phaniidæ*. The description agrees well with *W. atripennis* (see description of latter in this paper), yet there is room for doubt, as it entirely omits mention of the most important characters. Under these circumstances, I believe it advisable to indicate *Phasia atripennis* Say as a doubtful synonym of *Wahlbergia atripennis* nov. sp., and it may be so considered until it is identified as distinct.

Hyalomyia occidentis Wlk. and *H. triangulifera* H. Lw. I can identify none of the following four new species with either of the above.

Hyalomyia punctigera n. sp.

Male—Eyes reddish-brown, rather closely approximated just in front of the ocelli; front narrow, widening toward the antennæ; vitta black, obsolete in front of the vertex, much widened at the base of the antennæ, being thus triangular, with a row of fine black bristles on each side; sides of front silvery; face and ocellar borders silvery, the epistoma very strongly, unusually produced; antennæ blackish; proboscis and palpi blackish, the latter slender, rather elongate, and much enlarged at the tip; occiput black, silvery pollinose on the sides and below, brownish near the vertex, gray hairy below; cheeks silvery, gray hairy below. Thorax above black, slightly brownish pollinose, with short black hair; shoulders and pleuræ slightly brownish or cinereous; scutellum shining black; thorax and scutellum with black bristles on the sides and behind. Abdomen black, with an interrupted, somewhat indistinct, median black vitta; first two segments shining, with a metallic greenish luster, covered with short black hair; last two and anal segments, and median hind border of second segment, metallic, cinereous pollinose, covered with short, black, scattered hairs, each one arising from an opaque black dot, this punctation rather more distinct than in other species; venter concolorous, slightly cinereous on the posterior half. Legs black, black hairy, especially the femora, which are considerably enlarged; pulvilli whitish, claws black, elongate. Wings hyaline, broadly tawny at base; tegulæ tawny, forward scales partly whitish; halteres tawny.

Length of body, 5 mm.; of wing, 4 mm.

One specimen. Dixie Landing, Va. (D. C.). This is a very distinct form in the unusually prominent epistoma, the club-like palpi and the enlarged femora. No doubt further specimens will vary from the above in the extent of the cinereous on the abdomen.

* Mr. E. Girschner has referred this to a new sub-genus, *Paralophora* See Zeitschr. für Naturw., Bd. LX, 1887. Separate, 1888, p. 38.

Hyalomyia aldrichii nov. sp.

Male—Black. Eyes brown, closely approximated in front of the ocelli, thus very much narrowing the front at this point; vitta nearly or quite obsolete, only showing as a triangle at base of antennæ, brownish or nearly black; sides of front silvery, extending to the vertex as a silvery vitta, with a row of fine black bristles on each side; face and ocellar borders black, cinereous pollinose; antennæ black, slightly cinereous; proboscis black; palpi blackish, thread-like, very slightly or scarcely at all enlarged at the tip; cheeks black, silvery pollinose, gray hairy; occiput black, black hairy on upper border, silvery pollinose on sides and below. Thorax and scutellum shining black, of a metallic, very dark greenish luster, with black bristles on the sides and behind; shoulders and pleuræ concolorous, very slightly, almost imperceptibly, cinereous. Abdomen black, metallic, with a median interrupted, or almost obsolete, black line; first segment shining, with a dark greenish reflection, clothed with short black hair; remaining segments cinereous pollinose, with scattered black hairs, each arising from a black dot; venter concolorous, anal half more or less cinereous. Legs black, black hairy, especially at enlarged femora; pulvilli whitish. Claws black, rather elongate. Wings hyaline, slightly yellowish at base; tegulæ nearly pure white, hind scale faintly grayish; halteres slightly yellowish, more or less dusky.

Female—Differs from the male in having the eyes still more closely approximated, almost contiguous, and the claws very short. The frontal vitta is more distinct, and continued to the vertex as a narrow line. The shoulders and pleuræ also are more cinereous. The anal or fifth segment, present in the ♂, is wanting.

Length of body, 3 to 3½ mm.; of wing, 3 mm., or slightly more.

Described from 2 ♀ and 2 ♂ specimens. Brookings, South Dakota. From Mr. J. M. Aldrich. A third ♂ from the same locality differs in being smaller and much narrower, but is probably the same species.

Hyalomyia robertsonii n. sp.

Female—Eyes almost contiguous in front of the ocelli; front cinereous, bristly on each side of the black vitta, which is widened towards the antennæ; antennæ black, third joint cinereous; face and cheeks cinereous, the latter with fine whitish hairs; proboscis blackish, palpi rather short, slender, not enlarged at tip, tawny, blackish at base; occiput cinereous, with short black hairs, becoming whitish below; vertex with a posterior pair of bristles directed backward, one at each vertical angle, and an anterior pair situated between the three ocelli, directed forward. Thorax black above, cinereous on the sides, with black bristles on the sides before the wings, and on the posterior part of the dorsum; scutellum black, with four black bristles. Abdomen slightly cinereous,

the basal segments more or less metallic, black or greenish, the terminal segments more or less distinctly black punctate; venter slightly cinereous. Legs black, with a very faint grayish shimmer in some lights; claws short, pulvilli small, whitish or testaceous. Wings nearly hyaline, basal and costal portions deep tawny; tegulæ tawny, forward scale somewhat lighter; halteres tawny.

Length of body, 4 to 4½ mm.; of wing, 3½ to 4 mm.

Two females from Mr. Charles Robertson, Carlinville, Ills. This species is easily to be distinguished from *punctigera* by the much less prominent epistoma and the rather short, not club-like palpi. The femora also are scarcely enlarged. From *aldrichii* it may be distinguished by its slightly larger size, by the tawny tegulæ, which are white in that species, and by the palpi being largely tawny instead of wholly black.

Hyalomyia purpurascens n. sp.

Male—Face and front black, cinereous pollinose; eyes rather widely separated, brownish or reddish; frontal vitta as a narrow line between the eyes but widened towards the base of the antennæ, black, with a row of fine black hairs on each side; antennæ very small, black, third joint cinereous; proboscis blackish, palpi very small, tawny or testaceous; cheeks and occiput black, cinereous pollinose, the former below the eyes with fine whitish hairs, the latter with short black bristly hairs; vertex with short bristles. Thorax black, shining, slightly cinereous on the sides, with bristly hairs on the sides and bristles on the dorsum behind; scutellum black, with four bristles. Abdomen metallic, very dark green, usually with a decidedly purplish tinge on the second and third segments, the fourth segment, and sometimes the sides of the others, more or less ashy, black punctate; venter black, more or less cinereous. Legs black, the hind tibiæ with a few black bristles, the femora slightly enlarged; claws long, pulvilli whitish. Wings hyaline or grayish, basal portions tawny; tegulæ tawny or whitish; halteres tawny.

Female—Differs from the male in the eyes being contiguous just in front of the ocelli, the claws short, and the abdomen not purplish, more broadly punctate.

Length of body, 2½ to 3½ mm.; of wing, 2 to 3 mm.

Described from four males and four females, from Mr. Charles Robertson, Carlinville, Ills. This is a much smaller species than the three preceding.

Trichopoda ciliata Fab. Wiedemann's description of this species makes it very evident that he was describing the ♀. Brauer and von Bergenstamm (Vorarb. Mon. Muscaria Schiz., 147) indicate this to be the ♀ of *pennipes*. I believe this synonymy to be correct.

T. cilipes Wied. This is Fabricius's *Thereva pennipes* (Syst. Antl., 219, 8). The description is of the ♂. I believe this species to be the ♂ of *hirtipes*. I have a pair, taken *in coitu* June 22, which, with several other specimens taken singly, correspond with these two descriptions. The males have the wings milky and tawny radiate, the tawny being more or less in the form of a blotch.

T. flavicornis Rob. Desv. Robineau Desvoidy described the ♂.

T. formosa Wied. I have 3 ♂ and 2 ♀ of this species from this vicinity. It is very near *radiata*, but is somewhat less robust. (See *T. radiata* and *T. lanipes*.)

T. hirtipes Fab. All the descriptions of this (Fab., Wied., Rob. Desv.) are of the ♀, and I believe it to be the ♀ of *cilipes*. (See *T. cilipes*.)

T. lanipes Fab. Wiedemann, Fabricius and Robineau Desvoidy describe its ♀. Brauer and v. Bergenstamm (l. c.) indicate this to be the ♀ of *formosa* F. I know of no *formosa* described by Fabricius. If Wiedemann's species is meant, the synonymy is incorrect. That author mentions both sexes, in which he was evidently mistaken, for he describes only the ♂. The ♀ of *formosa* Wied. has the abdomen orange on the basal half, while *lanipes* is entirely coal-black.

T. pennipes Fab. This is Fabricius's *Dictya pennipes* (Syst. Antl., 327, 5). It is found over the eastern half or more of the United States and in Mexico. All the descriptions are of the ♂. Say's *Phasia jugatoria* is the ♀ of this species. Baron Osten Sacken, in his note on Say's description, has the sexes changed. Say described the ♀. It is the ♂ that has the ferruginous or yellowish patch on the front of the wing, and the abdomen entirely ferruginous, though males also occur which have the abdomen faintly tipped with black. This (Say's *jugatoria*) is probably the same sex of the same species which Fabricius described as *ciliata*.

T. plumipes Fab. All the descriptions (Fab., Wied., Rob. Desv.) are of the ♀. The only difference between this species and *lanipes* seems to be that this has golden and *lanipes* white lines on the thorax. If this difference does not exist they are probably the same. I have never seen this species.

T. pyrrhogaster Wied. The description seems to be of the ♀. Mr. van der Wulp records this species from Guatemala (Biol. Centr.-Am.), and Mr. von Röder records it from Porto Rico.

T. radiata H. Lw. This is our largest and most striking species. Lœw described the ♂. I am confident that I have the ♀ in two specimens which have the sides of the face silvery instead of golden, the wings entirely black and the abdomen

cylindrical, red, with the tip black. I was at first much inclined to regard this as a synonym of *formosa* Wied. I have noticed that the broad-bodied ♂ ♂, when fresh and first captured, have the abdomen of a very distinct red as well as purplish hue, which settles into a dull purplish black as the specimen becomes older. The reddish bases of the femora vary much also, in some of my specimens being just perceptible, while in others the whole basal half is red. In one specimen the palpi are darker than in the others. My specimens of *formosa* have the palpi reddish or nearly black; all but one have the bases of the femora perceptibly red, while some of the males have the abdomen purplish, and it nearly always becomes purplish-black after drying for some time. Therefore, the distinguishing characters which Lœw pointed out between his species and *formosa* are not constant enough to be of much service. The two species are, however, both valid, and are easily distinguished, when a series of each is compared, by the wider abdomen in the ♂, and the wider head and thorax and general greater robustness in both sexes of *radiata*. *T. formosa* uniformly has a narrower head and body, and is less robust. There are no constant and well-marked colorational differences between the two, but *formosa* as a rule has darker palpi, less red on the femora, and less purplish on the abdomen of the ♂.

T. trifasciata H. Lw. I have a ♂ of this species from Kansas. It agrees well with Lœw's description, though the anal segment, as well as the three preceding, has a golden or brassy fascia, which is less interrupted in the middle than the others.

T. haitensis Rob. Desv. The ♀ is described. Mr. V. v. Röder (Dipt. Insel Portorico, Stett. Ent. Zeit., 1885, 344) makes this a synonym of *pyrrhogaster*. The latter seems to be somewhat larger than *haitensis*, and they are both evidently the same sex. I feel safe, however, in accepting Mr. v. Röder's synonymy as correct.

T. mexicana Macq. I have not seen the description of this species.

T. nigricauda Bigot. I believe this to be the ♀.

T. flava v. Röder, l. c., 343, 344. Porto Rico. This is a remarkable and exceptional species in its coloration, as it is almost entirely yellow, including the wings. From the fact that the face is golden, and from the general showy coloration, it is probably the ♂ that is described. The ♀ is always the more sombre of the two.

T. histris Walker, List. IV, 697, without locality. I have little doubt that this is *T. trifasciata* H. Lw. The description agrees in every particular, except that Walker's specimen

seems to have had only two abdominal fasciæ, while Lœw's had three, and a specimen of my own four. (See *trifasciata.*) Walker describes the ♂, and his description is sufficiently recognizable to stand, certainly so if the locality had been appended. The species, however, cannot fail to be American, as I know of no *Trichopoda* from any other part of the world.

Trichopoda aurantiaca nov. sp.

Male—Black and orange; like *T. formosa* Wied., but smaller and less robust. Head rather wide, eyes large, brownish; front about one-fourth the width of the head, the velvety black vitta occupying its entire width at the vertex and a little widened at the bases of the antennæ; sides of front and borders of eyes below golden yellow; face silvery pollinose, a blackish shining surface just above the epistoma; antennæ, including bristle, blackish, slightly silvery in some lights; cheeks yellowish, silvery pollinose and gray hairy; mouth parts light, proboscis black or brownish, palpi very dark brown; occiput black, silvery pollinose. Thorax black, with four short longitudinal brassy, slightly whitish, lines in front running back to a transverse one, the inner pair and the transverse line very delicate, the outer pair heavy and somewhat golden; thorax with black macrochetæ on the sides and hind portion, hind border silvery; scutellum black, silvery behind, with a black macrocheta on each side and a pair at the hind angle; pleuræ silvery pollinose. Abdomen flattened, rather square oblong, not very wide, of a light orange color shading into rusty toward the tip, its extreme base more or less black, everywhere covered with short black bristly hairs; anal segment with a silvery reflection; venter concolorous. Legs black, thickly clothed with short black bristles, the bases of the femora orange; coxæ silvery; hind tibiæ thickly black ciliate, or feathered; claws and pulvilli yellow, elongate, surmounted with a few fine, black, bristly hairs. Wings black, slightly white radiate, with an elongate longitudinal yellow or tawny spot in the middle near the front border; inner margin of wings narrowly hyaline, not reaching the apex; tegulæ light orange, forward angle pure white; halteres orange.

Length of body, 11 mm.; of wing, 9 mm.

One specimen. Dixie Landing, Va. (D. C.). July 6, on sumach bloom. This species is near *formosa*. It differs from it in being less robust, in the much smaller and narrowed abdomen, which is orange-colored. From *cilipes* (syn. *hirtipes*) it differs in the smaller, rather square oblong abdomen of equal width, not bulging on the sides, and the delicate whitish brassy, not heavy golden, markings of the thorax. Of course, in the above differences I refer only to the ♂ ♂. I have a single ♀ that may belong to this species, but it is doubtful. The abdomen is narrower, more cylindrical, and

pointed at the end than in the ♀♀ of other species, and is broadly tipped with black. The claws are shorter, hooked, and the tips black. This is the case with the ♀♀ of most species; the claws of the ♂♂ are usually linear and entirely yellow.

Acaulona costata v. d. Wulp, Biol. Centr.-Am., Dipt., II, 4. This exceedingly interesting new genus and species of *Phasiidæ* is founded on the description of two specimens, which Mr. van der Wulp refers with a query to the ♂ sex. The very short claws and pulvilli mentioned would indicate the ♀. The genus has much the facies of *Trichopoda*, as may be seen from the excellent colored figure.

Gymnosoma filiola H. Lw. I have taken this species here, and have also specimens from Iowa, Nebraska, South Dakota (Aldrich), and Minnesota (Lugger), while Lœw described it from Texas, and Mr. v. Röder has determined it in a collection of flies from Porto Rico (l. c., 344). Lœw mentions in his description that he had not observed any ♀♀ to have the widely dilated abdominal spots so frequently seen in larger species. I have, however, ♀♀ in which the black markings extend over nearly the whole abdomen.

G. fuliginosa Rob. Desv. This is our largest and most robust species. It is abundant here, and I have taken it in Michigan. The ♀, as in all Gymnosomas, has black on each side of the front, the face with a silvery reflection, the thorax wholly black shining, and the abdominal markings dilated. The ♂ has only the lateral angles of the vertex black, the face with a golden reflection, the forward part of the thorax with yellowish or brassy pubescence, and the abdominal markings confined to several small, round black spots. The claws are nearly the same length in both sexes, but the wings of the ♂ are as a rule slightly smaller than those of the ♀. Desvoidy described the ♂. It is perhaps a question whether this is not the same as *G. rotundata* L. of Europe (see v. d. Wulp, Tijd. v. Ent., 2d ser., II, 136).

G. occidua Wlk. This is, without doubt, as Dr. Williston has pointed out (Tr. Am. Ent. Soc., XIII, 296), the ♀ of *Cistogaster divisa* H. Lw. But Dr. Williston seems, in his paper, to accept Lœw's name, whereas Walker's, as it is accompanied by a recognizable description, ought to stand on its priority.

G. par Wlk. This may best be placed as a synonym of *fuliginosa* R. D., until some one decides from examination of the type in Cambridge that it is not identical. There is little doubt of its being the same.

G. latreillei Rob. Desvoidy, Myod., 237. The description is accompanied by the remark: "I do not know the country of this species; observed in the collection of the Count Dejean." I venture to rescue this from the fugitive list and refer it to North America, probably Carolina. From Desvoidy's description I have little doubt that it is the ♀ of *fuliginosa*.

G. atra Rob. Desv., Myod., 238. This is another of Desvoidy's fugitive species, which he found in Dejean's collection. I strongly suspect that it is the same as *Cistogaster pallasii* n. sp., described in this paper. If it is the same, I am rather surprised that Desvoidy did not refer it, on account of its short antennæ, to his genus *Pallasia* (syn. of *Cistogaster*). If, however, he trusted to the appearance of the specimen, its habitus is strikingly like *Gymnosoma*.

Cistogaster divisa H. Lw. This should be known as *occidua* Wlk. Lœw described the ♂ of Walker's species. It is found from Connecticut and District of Columbia to South Dakota (Aldrich), Colorado and California (Williston). There is little reliance to be placed on the character of the apical cell in this genus. While *Gymnosoma* uniformly has it petiolate, twenty-two specimens of *C. occidua* that I have examined have it petiolate (all ♂ ♂), and eleven have it closed in the border (seven ♀ ♀ and four ♂ ♂). The females of this species vary very much. I have one in which the abdomen is of the same bright ferruginous as that of the ♂, while a small specimen has the abdomen of a uniform black, nearly like *pallasii* n. sp., but not shining as in that species. In some females also the black on the sides of the front is of much greater extent and very pronounced. While the claws in *Gymnosoma* are nearly the same length in both sexes, those of the ♂ are much elongated in *Cistogaster*.

C. immaculata Mcq. I have not seen the description of this species.

Cistogaster pallasii nov. sp.

? Syn. *Gymnosoma atra* Rob. Desv.

Female—Wholly black. Front about one-third the width of the head, shining black on the sides with black hairs; vitta dark reddish-brown, of nearly equal width; face and borders of the eyes silvery white, pollinose; antennæ short, brownish, black at the tip; second joint reddish on the sides, slightly silvery in some lights, with a few black hairs on its dorsum; third joint a little longer than the second, reddish at base, the remainder black; proboscis blackish, palpi light reddish-yellow; cheeks and occiput cinereous pollinose, gray hairy on the sides and particularly below, with black hairs on the upper border. Thorax shining black,

without opaque on pollinose lines; humeri and pleuræ cinereous pollinose, the former slightly brassy in certain lights; scutellum shining black, with black bristles. Abdomen round, shining black, with thin black depressed pubescence becoming thicker on the edges; venter black. Legs wholly black, femora hairy, tibiæ hairy with a few bristles; pulvilli reddish, claws short. Wings small, hyaline, yellowish or tawny at base, the apical cell petiolate; tegulæ white, hind scale faintly tawny; halteres yellowish.

Length of body, 5 mm.; of wing, 4 mm.

One specimen. Brookings, South Dakota. From Mr. J. M. Aldrich. Further material will perhaps show specimens with the apical cell closed in the border, not petiolate.

Ocyptera arcuata Say. This must be known as *Wahlbergia arcuata*. I had referred it to this genus from the description alone, without examination of specimens. Later I received from Mr. Charles Robertson, of Carlinville, Ill., two ♂ ♂ and two ♀ ♀ that I am able to identify as this species, which has remained unknown since Say described it in 1829. Say's description was probably made from a female. The female differs from the male in having the dorsum of the thorax in front blackish in the middle, with the golden pubescence in a broad band on each side; in the face and sides of the front being silvery; and in the abdomen being pointed at the extremity, more conspicuously and compactly marked with black, the tip being wholly black above. The male has the thorax in front with golden lines, also in the middle; the face and sides of front golden; the abdomen blunt at the extremity, and the segments with the black slightly separated at the sutures.

O. (*Hemyda*)*aurata* Rob. Desv. The genus *Hemyda* is very distinct from *Ocyptera*. (See v. Röder, Berl. Ent. Zeitschr., XXV, 212; and Williston, Tr. Am. Ent. Soc., XIII, 297.)

O. carolinæ Rob. Desv. This is very near Walker's *dosiades*. Desvoidy states that the tegulæ are sub-fuliginous, and the thorax dull black tinged with brownish. The tegulæ of *dosiades* are white, and the thorax is shining, polished black. The other characters given by Desvoidy agree well with specimens which I refer to Walker's species.

O. dosiades Wlk. I have four ♂ and three ♀ specimens from this vicinity which I refer to this species, though the third antennal joint is scarcely twice as long as the second. I have also one ♂ from Minnesota (?) and two ♀ ♀ from here, which are smaller, but are likely the same species. The males have the claws elongate, while in the female they are very short. This seems to be our smallest form of *Ocyptera*.

O. epytus Wlk. I can see very little difference between the descriptions of this and the following species. This description was probably drawn from a small specimen of *euchenor*, and I should regard it as a synonym of that species, the description of which is better applicable to most of the specimens.

O. euchenor Wlk. I identify one ♂ from this vicinity, one ♂ from Iowa, two ♂ ♂ from Minnesota (?), and two ♂ ♂ and three ♀ ♀ from southern Illinois (Robertson), with this species.

O. liturata Olivier. I fail to identify this species in my material. It is, without much doubt, an *Ocyptera*, though the description of some of the parts, especially the wings, is wonderfully like *Trichopoda*.

O. dotadas Wlk. The description says that the abdomen is linear, which doubtless here means slender. The only differences I can perceive between the descriptions of this species and *dosiades* are that in this the median black abdominal vitta seems to be obsolete, the wings are longer, and the balancers are black instead of tawny. If I have put the right construction upon these points, the species is no doubt valid. The descriptions are exactly alike in all other particulars.

O. binotata Bigot, Ann. Soc. Ent. Fr., 1878, 44. This appears to be the same as *euchenor* Wlk. It is a much larger species (10 mm.) than *dosiades* Wlk.

Ocyptera argentea nov. sp.

Male—Black, silvery pollinose. Eyes dark brown; front nearly or quite one-third the width of the head, not nearly so broad as the face; vitta black, of equal width, with a row of black bristles on each side; sides of front borders of the eyes and face silvery-white pollinose, grayish in some lights; antennæ black, third joint only a little longer than the second; proboscis black; palpi undeveloped; cheeks and occiput gray hairy, silvery-white pollinose; a pair of long black bristles on the vertex, one on each side of the ocelli. Thorax black, with a silvery reflection, covered with black macrochetæ; shoulders and pleuræ silvery pollinose, also three longitudinal, abbreviated silvery vittæ on the middle of the front portion of the thorax; scutellum black, with a faintly silvery reflection, four-sided, narrower posteriorly, with black macrochetæ on its sides and behind. Abdomen black, shining, with lateral and dorsal pairs of black macrochetæ always near the hind margin of the segments; second segment and front half of third obscurely red on the sides, the red often hardly perceptible from above; forward half of third and fourth segments broadly silvery-white pollinose on the sides; venter black, second segment and a part of third red. Legs black, coxæ and the hind surface of the front femora silvery-pollinose, femora and

tibiæ with black macrochetæ; pulvilli tawny or testaceous; claws black, elongate. Wings smoky, gradually sub-hyaline on the inner margin, more or less yellowish at base; tegulæ white, sometimes faintly yellowish on the internal or the whole border; halteres black.

Female—Differs from tho ♂ in the very short claws, and in the more nearly equal width of the front and face when viewed from before.

Length of body, 10 to 11 mm.; of wing, 7 mm.

Three ♂ ♂ from District of Columbia and one ♀ from Iowa. It differs from *euchenor* in the sides of the second and third abdominal segments not being clearly red, but the third segment covered with silvery-white pollen in front like the fourth. The whole insect is more deeply black and the antennæ are entirely black.

Wahlbergia atripennis nov. sp.

? Syn. *Phasia atripennis* Say.

Male—Black and light orange. Head wider than the thorax; eyes large, brown; front nearly one-third the width of the head, with a broad, deep black, velvet-like vitta occupying the entire width at the vertex, but narrower towards the antennæ, at the bases of which it widens again; sides of the anterior three-fourths of the front, with the borders of the eyes, bright golden, face light yellow; antennæ short, blackish, third joint nearly the same length as the second, reddish at base, the second joint shading to reddish and black bristly; proboscis black or brownish, geniculate, the upper membranous portions whitish; palpi light reddish-yellow, black hairy; cheeks and occiput silvery, with grayish hairs below and black hairs on the upper border. Thorax velvet black, with black bristles, the transverse suture golden, irregularly defined in front, humeri broadly golden; posterior margin of mesoscutum golden, extending forward nearly to the transverse suture; pleuræ silvery, upper portions golden in certain lights; scutellum black, with black macrochetæ. Abdomen cylindrical, of a clear light orange-yellow, covered with short black depressed bristles, becoming thinner on the sides and venter; first segment deep black at base, in some specimens nearly all black, in others just touched with black; fifth and sixth segments and posterior or greater part of dorsum of fourth, with median dorsal spots of second and third segments, usually much darker, of a light rusty or pale ferruginous; a median dorsal pair of sub-erect short black macrochetæ near the posterior border of each segment; venter of first three segments and often a portion of the fourth light yellow, at tip blackish. Legs black, basal third to half of front and middle femora and three-fifths of hind femora orange-yellow; coxæ yellowish, covered with silvery pollen; femora evenly covered with short depressed bristly hairs; rest of legs rather more finely hairy, tibiæ in addition with a few strong bristles, usually about 8 or 10 on each hind tibia and from 1 to 5 or 6 on the front and middle pairs; claws long, of equal length with the

pulvilli, which are dusky. Wings smoky, almost black on the costal half and at base, the inner margin gradually sub-hyaline; apical cell rather long petiolate, hind cross-vein more or less bowed out; tegulæ light orange-yellow, the anterior half and smaller forward scale pure white, with the borders faintly yellow; halteres light orange-yellow.

Length of body, 6 to 7 mm.; of wing, 5 to 6 mm.

Dixie Landing, Va. (D. C.). Four specimens taken Oct. 5, on flowers of aster, etc.

This species at first sight exactly resembles a small *Trichopoda*, but is easily distinguished from that genus by the bare hind tibiæ, long-petiolate apical cell, and the short abdominal pairs of macrochetæ.

Schiner defines *Besseria* (syn. of *Wahlbergia*) as having the hind cross-vein straight. Lœw's description of *W. brevipennis* states that vein to be strongly oblique. In the above species it is arcuate, and the fourth longitudinal vein is flexed or rounded, not angulated, where it bends to meet the third.

Mr. Schwarz presented the following note:

FEEDING HABIT OF A SPECIES OF EMPIDÆ.

By E. A. Schwarz.

That the *Empidæ* are predaceous Diptera is well known, but since I do not find in the more accessible literature (although no particular search has been made) any published record regarding their mode of feeding, I venture to communicate a little observation made by myself the present summer. A species of the genus *Syneches* (probably an undescribed species) was very abundant in the mountains at Ft. Pendleton, Md., during the first part of July. During daytime these flies rest on the under side of leaves, etc., in the shadiest parts of the woods. Toward evening they fly about in the more open places and capture little gnats and other minute Diptera. Holding their prey between the legs, and their body being in vertical position, they slowly fly toward the nearest bush, and, without alighting, most dexterously manage to take hold of the edge of a leaf with the claws of the right or left front leg. The long and very sharp claws are well adapted for taking a firm hold on the surface of the leaf, and the long pulvilli assist in the operation by pressing on the edge or the under side of the leaf. Thus vertically suspended by a single leg, the fly uses its five free legs for manipulating the gnat. Within ten or fifteen seconds it has sucked out its prey, then drops the same and flies away. On a single shrub alongside

a road I could see at the same time thirty or more specimens of the fly all suspended in exactly the same way, while numerous others were constantly going or coming.

With reference to the manner of flight described in this note on *Empidæ*, Prof. Riley said that long-bodied insects of slow flight must necessarily hang more or less vertically, instancing the flight of long-bodied Lepidoptera, Lampyridæ, Tipulidæ, etc. With reference to the hanging of these flies while feeding, he said that it was not uncommon for Bombi to hang suspended by their jaws to plants while asleep.

Mr. J. M. Aldrich mentioned having observed a large Asilid apparently asleep hanging from a blade of grass by its fore feet, and holding a large beetle.

Mr. Marlatt mentioned having noticed a wasp (*Cerceris fumipennis* Say) for two days in succession hanging to a particular plant of *Solidago*. Examination showed that the wasp, which was hanging by its jaws, was dead, it having evidently died during sleep.

Mr. Mann said that he had found a bee sleeping in this position. Attention was also called to Mr. Emerton's figure in Psyche, Vol. 5, of *Vespa maculata* hanging by a single hind foot and feeding on a fly.

Mr. Howard mentioned Thaxter's figure of *Chauliognathus pennsylvanicus* infected by an entomophthorus disease hanging by its jaws to the edge of a leaf (Mem. Boston Soc. Nat. Hist., v. 4).

Mr. Schwarz called attention to a recent publication by Ed. Fleutiaux and A. Sallé in the Ann. Soc. Ent. de France for 1889 (1890), on the Coleoptera from the Island of Guadeloupe, West Indies. Of five hundred and seventeen species there enumerated not less than seventy occur also in the United States, and these can be classified as follows: twenty are cosmopolitan species; twenty-eight are more or less widely distributed in North America, and more especially in the southern States; twenty-two belong to the colony of semi-tropical insects in North America, most of them occurring in the semi-tropical belt of Florida and a few in the extreme southwestern region of the country.

JANUARY 4TH, 1891.

The sixty-eighth regular meeting and Sixth Annual Meeting.

President Marx in the chair. Eleven members and two visitors present.

The officers for the past year were re-elected as follows:—President, George Marx; Vice-Presidents, C. V. Riley and L. O. Howard; Recording Secretary, C. L. Marlatt; Corresponding Secretary, C. H. Tyler Townsend; Treasurer, B. Pickman Mann; Executive Committee, E. A. Schwarz, Otto Heidemann and William H. Fox.

The President, Dr. Marx, delivered his Annual Address:

ANNUAL ADDRESS OF THE PRESIDENT.

A LIST OF THE ARANEÆ OF THE DISTRICT OF COLUMBIA.

By Dr. Geo. Marx.

In selecting a theme for my presidential address, I was induced by several reasons to choose as such a paper on the local Spider-fauna of the District of Columbia.

First, I wanted to avail myself of the opportunity to report my part as a member of a committee of this Society, appointed two years ago to prepare faunal lists of the District for the different branches of Entomology.

Secondly, I hoped that by presenting to you a list of the Spiders collected by me in this region I could induce my co-laborers in Arachnology to follow my example and contribute such additions to my incomplete work as would reflect a greater value upon it.

The third reason was the importance of the subject; for the first and most important foundation-stone for the knowledge of the limits of those cosmic conditions under which a biological species is able to exist, or, in other words, its geographical distribution, is a well determined list of a local fauna. May such a list be ever so small and incomplete, providing the determinations are correct, it will serve as a

starting point for further workers; it will stimulate others to augment and enhance its scope.

With a number of such local Spider lists put side by side, thus covering a large area of territory, great results have been achieved in European countries, not alone in regard to the knowledge of the geographical distribution of the Araneæ, but also to the general advancement of the science of Arachnology.

In England nearly every indigenous Spider is now known; every new addition immediately recorded—the result accomplished by the numerous lists of local faunas. France, Germany, Sweden and Austria owe their advanced states of the knowledge of their Spider-fauna to the same sources, and even Russia has a great number of local lists on the same subject.

In this country we have only a small number of occasional papers on local Spider-faunas, prepared mostly by European writers from material sent to them from one locality or another.

The first and most comprehenive work, which would have served under other circumstances as an excellent starting point in this direction, is *Abbot's Georgia Spiders*, a catalogue of over five hundred new species, carefully illustrated, and nearly all collected in the State of Georgia. Unfortunately this very valuable work fell into the hands of Europeans, and the species were described by Baron Walckenaer[1] in such vague and insufficient manner that only a small number could, up to the present time, be recognized.

In 1869 Prof. C. G. Giebel[2] published a list of seven species from Illinois, and J. Blackwall[3] a list of nine species from Montreal, Canada. Thorell[4] described in 1875 ten species from Labrador, and the same author[5] published a list of thirty-three species which were collected by Packard in Boulder

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[1] Walckenaer—Histoire natur. des Ins. Aptères, I and II, 1837.

[2] C. G. Giebel—Ueber einige Spinn. a. Illinois. Zeitschr. f ges. Naturwiss. XXXIII, 1869.

[3] Blackwall—Notice of Spiders captured by Miss Hunter in Montreal, Can. Ann. and Mag. Nat. Hist., VIII, 1871.

[4] T. Thorell—Notice of some Spiders from Labrador. Proc. Bost. Soc. Nat. Hist., XVII, 1875.

[5] T. Thorell—Araneæ collected in Colorado. Bull. U. S. Geol. Survey Terr., III, No. 2, 1877.

County, Colorado. In 1881 Rev. O. P. Cambridge[1] described three species from Newfoundland, and in 1885 Mr. F. W. Cragin[2] published a list of ten Spiders from Kansas.

These are all the local lists of Spiders published heretofore in this country.

Washington, the seat of many scientific institutions, can also boast of quite a number of professional entomologists, and adding to them the little flock of amateur naturalists, who find pleasure and recreation in the study of entomology outside of their daily occupations, this city can be proud of its number of representatives of this branch of natural science; but I must state here that the amateur naturalists are greater enthusiasts, more diligent workers, possess larger collections, and have in general done more to explore the territory of the District in regard to its entomological fauna than their professional brethren.

All of our entomologists seem to prefer certain old localities for collecting, where they are sure to be rewarded for their labors, instead of hunting for new fields. Our oldest entomologist in the District, who accumulated during the thirty-five years of his residence here one of the finest collections of Coleoptera, has always visited his few old hunting places over again, and can hardly be induced to try a new locality. The consequence is that the territory of the District of Columbia is by no means fully explored, and to speak of a list of Spiders from here means only a list of a part of this territory.

For over ten years I have been the sole collector of Arachnida in the District of Columbia, and I must confess that I have followed the example of my entomological colleagues and visited generally the same localities, viz., Soldiers' Home, the Virginia border of the Potomac and the Rock Creek valley, with a few excursions to Bladensburg, the lower Potomac, and Great Falls and Cabin John's Bridge.

[1] Cambridge—On some Spiders from Newfoundland. Proceed. Royal Physic. Soc., 1881.

[2] F. W. Cragin—First Contrib. to Knowl. of Arachn. of Kansas. Bull. Washburn College, I, No. 4, 1885.

For the past two years I have had in my friend, Dr. Wm. H. Fox, of this city, a valuable colleague in Arachnology, who has, by untiring and systematic labors, acquired quite an extensive collection of Araneæ, although he has confined his hunting grounds almost exclusively to a small area in the Rock Creek valley, and I owe to this gentleman some valuable additions to my own material in compiling this paper.

Quite lately another Arachnologist, Mr. N. Banks, has to be added to the force which explores the Spider-fauna of the District.

There exist two principal conditions by which the territory of the District of Columbia has become particularly favorable for a rich representation of insects and Arachnida. These conditions are its geographical situation and its peculiar topography.

The District is located at one of those interdigitations of the two great faunal zones of our continent—the Boreal and the Sonoran, or, to be more definite, of the most easterly of the boreal branches, the Alleghanian, and that sub-region of the Sonoran zone, known as the Louisianian or Austroriparian branch. Both of these regions meet and intermingle here, and we find here, therefore, representatives of the Arachnidan fauna of both zones.

The second favorable condition we find in the diverse and peculiar elements of its topography. A large river—the Potomac—flows through its entire length from north to south, coming from the mountains of West Virginia and western Maryland, and bringing many forms to us which otherwise would hardly be found so far south ; on the other hand, by its course into the Chesapeake Bay, this great waterway opens the road for many southern species.

The large tributary of the Potomac, the Eastern Branch, with the almost stagnant waters at its lower course, only moved by the ebb and tide, with its swampy and, for the most part, uncultivated shore, offers an excellent breeding place and habitation for palustral genera.

Another tributary in the District—the Rock Creek, with its many small branches, by its course through hill and dale,

through meadows and rocky cliffs, gives a beneficial influence to a large part of the territory of the District for the subsistence of the many and varied elements of its Spider-fauna.

Water, either stagnant or flowing, always exerts a great influence upon the existence and prolific livelihood of the Spider-fauna of a region, as such a condition secures and promotes an abundant supply of insects, which serve as food for Spiders.

The surface of our territory is undulating and in some parts rather broken. Many of the elevations are covered with dense woods of various kinds; and these, with the verdant meadows and the barren hills in their varied alterations, offer a most suitable abode for the many forms of Arachnida.

Of course we cannot expect to meet representatives of all the seven orders of this class in the territory of the District: such forms as the *Galeodes*, the *Pedipalpi* and the Scorpions are by climatic reasons excluded from our locality, while the orders *Araneæ*, *Opiliones*, *Chelonethi* and *Acari* are here well represented. It may, however, be proved in future that the Scorpion is also an inhabitant of the District of Columbia, as one species of this order, the *Centrurus vittatus* Say has been found near Fortress Monroe, Va., in Talbot county, Maryland, and in one instance in Baltimore county, and it seems to me quite possible that we may also meet with it here, as it prefers in this latitude the half loose bark of the Southern Long-leafed Pine (*Pinus tæda*) as a habitation.

The result of my collecting of *Araneæ* in the District for the last twelve years is as follows:

The total number of species collected in the limits of the District of Columbia is 370, of which 62 are new and undescribed; the remaining 308 have been described and recorded as coming also from other parts of the United States.

The families, according to their richness of species, may be arranged as follows:

Fam.	Theridiidæ,	21 genera,	83	species.
"	Epeiridæ,	13 "	43	"
"	Thomisidæ,	11 "	35	"
"	Lycosidæ,	7 "	32	"
"	Clubionidæ,	7 "	28	"
"	Attidæ,	17 "	25	"
"	Dictynidæ,	5 "	12	"
"	Agalenidæ,	5 "	12	"
"	Drassidæ,	4 "	10	"
"	Tetragnathidæ,	4 "	9	"
"	Theraphosidæ,	3 "	4	"
"	Pholcidæ,	2 "	3	"
"	Uloboridæ,	2 "	3	"
"	Oxyopidæ,	1 genus,	3	"
"	Dysderidæ,	2 genera,	2	"
"	Scytodidæ,	1 genus,	1	"
"	Calommatidæ,	1 "	1	"

List of the Described Species of Araneæ Collected in the District of Columbia.

The letters used before the dates signify as follows: A, found once only; B, rare; C, not very frequent; D, common; E, very common.

TERRITELARIÆ.

Fam. Calommatidæ.

1. *Atypus abbotii Walck.* near Bladensburg, . . A Aug.

Fam. Theraphosidæ.

2. *Pachylomerus audouini Luc.* near Prospect Hill cemetery, A May.
3. *Brachybothrium marxii Atk.* Occoquan Falls, Va., A June.
4. *robustum Simon.* Occoquan Falls, Va., A Aug.
5. *Myrmekiaphila atkinsonii Simon.* Fort Washington, A Sept.

FILITELARIÆ.

Fam. Dysderidæ.

6. *Dysdera crocata C. K.* D. C., under shelter, C all yr.
7. *Ariadne pallida C. K.* Cabin John's Bridge, Potomac hills, C all yr.

Fam. SCYTODIDÆ.

8. *Scytodes thoracica Latr.* Soldiers' Home, in web, between shrubs, A Aug.

Fam. PHOLCIDÆ.

9. *Pholcus phalangioides Fuesl.* D.C., in dark places in buildings, E Mch.-Oct.
10. *cornutus Keys.* Washington, in a cellar, A July.
11. *Spermophora meridionalis Hz.* D. C., in buildings and under cliffs, E May-Oct.

TUBITELARIÆ.

Fam. DRASSIDÆ.

12. *Micaria aurata Hz.* Smithsonian and Agricultural grounds, Potomac hills, B Apr.-July.
13. *montana Em.* Rock Creek. Great Falls, C June-Aug.
14. *longipes Em.* Potomas hills, first cascade, B Sept.
15. *Drassus robustus Em.* Soldiers' Home, A Sept.
16. *neglectus Keys.* Agricultural grounds, under boards, A Oct.
17. *Prosthesima atra Hz.* D. C. D Sept.-Nov.
18. *ecclesiastica Hz.* Potomac hills, Great Falls, Ft. Washington, C.
19. *depressa Em* Bladensburg, A June.
20. *Pœcilochroa varigata Hz.* Potomac hills, Soldiers' Home, C.
21. *bilineata Hz.* Great Falls, between the rocks, B.

Fam. DICTYNIDÆ.

22. *Dictyna volupis Keys.* D. C., in webs on walls, D May-Oct.
23. *volucripes Keys.* Ft. Washington, in old barracks, C.
24. *arundinaceoides Keys.* Potomac hills, Rock Creek, C Sept.-Oct.
25. *pallida Keys.* Cabin John's Bridge, B June.
26. *sedentaria Keys.* Potomac hills, tow-path to Alexandria, B Je.-Jy.
27. *frondea Em.* Rock Creek, C.
28. *cruciata Em.* Rock Creek, C.
29. *Scotolathys pallida Marx.* Rock Creek, in winter, C Dec.-Feb.
30. *Prodalia foxii Marx.* Rock Creek, B.
31. *Titanœca brunnea Em.* Potomac hills, near Chain Bridge, B Oct.-Nov.
32. *Amaurobius ferox C. K.* D. C., on walls, hibernating, C Mch.-Oct.
33. *claustrarius C. K.* D. C., viaduct under canal, Va., hibernating, D March.

Fam. CLUBIONIDÆ.

34. *Anyphœna sublurida Hz.* Potomac hills, Giesboro Point, B June.
35. *calcarata Em.* Woodly Lane, A Sept.
36. *fallens Hz.* Potomac hills, Great Falls, D May-Sept.
37. *pectorosa L. K.* Bladensburg, near creek, A Aug.
38. *gracilis Hz.* D. C., D May-Sept.
39. *incerta Keys.* Potomac hills, Rock Creek, Woodly Lane, C May-Sept.
40. *inclusa Hz.* Alexandria, Potomac hills, C July-Oct.

41. *Anyphæna saltabunda Hz.* Potomac hills, Analostan Island, C June.
42. *Clubiona abbotii L. K.* Bladensburg, Cabin John's Br., Soldier's H., D Aug.
43. *crassipalpis Keys.* Potomac hills, Rock Creek, C May-July.
44. *minuta Em.* D. C., D Jan.-Dec.
45. *rubra Keys.* Bladensburg, St., Elizabeth, C June-Oct.
46. *pallens Hz.* D. C., sweeping, also in leaves with cocoon, D May-Oct.
47. *tibialis Em.* On border of swamp of the Eastern Branch, C Jan.
48. *riparia L. K.* Bladensburg, Soldier's Home on trees, B Aug.
49. *Chiracanthium albens Hz.* D. C., D May-Oct.
50. *viride Em.* Potomac hills, Rock Creek, C June-July.
51. *Trachelas tranquillus* Hz.* D. C., on ground, D May-Oct.
52. *Thargalia cingulata C. K.* Ft. Washington, on a tree, A Aug.
53. *crocata Hz.* Bladensburg and Potomac hills, C June-Sept.
54. *ornata Hz.* Great Falls, Occoquan Falls, B June-Aug.
55. *trilineata Hz.* Occoquan Falls, near the falls, B Aug.
56. *longipes Em.* Rock Creek, B May.
57. *Agrœca tristis Keys.* Agricultural grounds, under boards, A May.
58. *Phrurolithus alarius Hz.* D. C., E May-Sept.
59. *dubius Hz.* Carp ponds garden, on leaves of Lotos, A Sept.
60. *pugnatus Hz.* D. C., E all year.

Fam. AGALENIDÆ.

61. *Agalena nævia Hz.* D. C., E May-Oct.
62. *hentzii Becker*, Potomac hills, Gr. Falls, betw. the rocks, C Je-Aug.
63. *Tegenaria derhami Scop.* D. C., D Spring-fall.
64. *brevis Em.* D. C., B May.
65. *Cicurina arcuata Keys.* D. C., D Apr. Sept.
66. *pallida Keys.* Rock Creek, near Pierce mills, C June.
67. *Cœlotes calcaratus Keys.* Potomac hills, near old fort, C July-Aug.
68. *lamellosus Keys.* Bladensburg, old mill creek, D June-Sept.
69. *urbanus Keys.* Smithsonian grounds, on larch tree, B June.
70. *Hahnia agilis Keys.* Rock Creek, Great Falls, B April-Aug.
71. *bimaculata Em.* D. C.,
72. *cinerea Em.* D. C.

RETITELARIÆ.

Fam. THERIDIIDÆ.

73. *Theridium differens Hz.* Potomac hills, Rock Creek, D July-Oct.
74. *flavonotatum Becker.* Agricultural grounds, A July.
75. *frondeum Hz.* D. C., D May-Nov.
76. *globosum Hz.* Great Falls, in grass, B Aug.
77. *Kentuckyense Keys.* Potomac hills, Rock Creek, C May.
78. *murarium Em.* D. C., E May-Nov.

* *Trachelas ruber* Keys. is identical with Hentz's *Clubiona tranquilla*, which name is the older, and has to be substituted therefore for Keyserling's.

79. *Theridium nicoleti Keys.* Agricultural grounds, A June.
80. *punctosparsum Em.* Potomac hills, Rock Creek, C Mch.–Oct.
81. *spirale Em.* Rock Creek, Potomac hills, Gr. Falls, D Je.–Sept.
82. *studiosum Hz.* Carp pond garden, Bladensburg, near old mill creek, C June–Aug.
83. *tepidariorum C. K.* D. C., E all year.
84. *unimaculatum Em.* Rock Creek, Potomac hills, Giesboro Point, D May–Sept.
85. *zelotypum Em.* Potomac hills, tow-path to Alexandria, C June.
86. *Achæa ignota Keys.* Occoquan Falls, on web between trees, A Aug.
87. *Stealoda borealia Hz.* D. C., E Jan.–Dec.
88. *nigra Em.* Rock Creek, Potomac hills, C June–Sept.
89. *Teutana triangulosa Walck.* D. C., in houses, E
90. *grossa C. K.* Occoquan Falls, in grass, A Aug.
91. *Lithyphantes corrolatus Linn.* Rock Creek, C May.
92. *marmoratus Hz.* D. C., D April–Nov.
93. *Lathrodectus mactans Walck.* D. C., under stones, D May–Nov.
94. *Spintharus flavidus Hz.* D. C., D May–Oct.
95. *Argyrodes argyrodes Walck.* Potomac hills, Agricultural grounds, C June–Sept.
96. *cancellatus Hz.* Potomac hills, on tow-path to Alexandria, B Sept.
97. *Episinus truncatus Walck.* Rock Creek, Potomac hills, B Aug.
98. *Asagena americana Em.* Potomac hills, Great Falls, C May–Sept.
99. *Mimetus interfector Hz.* D. C., D Apr.–Oct.
100. *Ero furcata Vill.* Rock Creek, B June.
101. *Theridula sphærula Hz.* D. C., on trees, D June–Sept.
102. *Ulesanis americana Em.* Potomac hills, nr. Fort Meyer, Glenwood, B Aug.
103. *Crustulina sticta Keys.* D. C., E June–Nov.
104. *Dipæna buccales Keys.* Potomac hills, near Chain Bridge, B June.
105. *Euryopis argentea Em.* Soldiers' Home, Rock Creek, C May–June.
106. *funebris Hz.* D. C., E May–Oct.
107. *Linyphia angulata Em.* Rock Creek, B March.
108. *autumnalis Hz.* Department of Agriculture grounds, on Magnolia tree, B April
109. *communis Hz.* D. C., E Apr.–Nov.
110. *concolor Reuss.* Great Falls, between the rocks, B Aug.
111. *drassoides Em.* Potomac hills, Rock Creek, C May–Nov.
112. *galbea Keys.* Potomac hills, near Chain Bridge, B Sept.
113. *insignis Keys.* Potomac hills, Department of Agriculture grounds, B June.
114. *mandibulata Em.* Potomac hills, Bladensb'g, Rock Creek, C Je.
115. *marginata C. K.* D. C., D June–Sept.
116. *micaria Em.* Rock Creek, Cabin John's Bridge, E May–Nov.
117. *nebulosa Sund.* Potomac hills, Rock Creek, D May–Oct.
118. *nigrina Em.* Potomac hills, Rock Creek, C Apr.–Oct.
119. *phrygiana C. K.* D. C., sweeping, E May–Sept.
120. *pusilla Sund.* Rock Creek, Fort Washington, D Sept.–Nov.

Linyphia socialis Sund. Potomac hills, on tow-path to Alexandria, B Sept.
sabulosa Keys. Potomac hills, Rock Creek, C May
Frontinia clathrata Sund. Potomac hills, Soldiers' Home, Giesboro Point, C May–Sept.
coccinea Hz. Occoquan Falls, near the falls in web between shrubs, B Aug.
Phlocomma hirsutum Em. Potomac hills, B Nov.
rostratum Em. Potomac hills, B Nov.
Erigone alba Fox. Rock Creek, A March.
alticeps Fox. Rock Creek, B March.
atriceps Cambr. Rock Creek, Potomac hills, C Mar.–Sept.
autumnalis Em. Rock Creek, C Oct.
bulbosula Keys. Giesboro Point, A Sept.
depressa Em. Rock Creek,
directa Cambr. Potomac hills, A Aug.
emertonii Cambr. Potomac hills, Rock Creek, Giesboro Point, D Mar.–Sept.
fabra Keys. Potomac hills, Rock Creek, Soldiers' Home, D Mar.–Oct.
fissiceps Cambr. D. C., Soldiers' Home, E Feb.–Nov.
florens Cambr. Beltsville, Md., Potomac hills, D June–Sept.
formica Em. Potomac hills on tow-path to Alexandria, B Sept.
interpres Cambr. D. C., D Aug.–Nov.
lactabilis Cambr. Potomac hills, Rock Creek, D March.
melanocnemus Fox. Rock Creek, C March.
micropalpis Em. Rock Creek. C March.
minuta Em. Rock Creek, B March.
montifera Em. Potomac hills, Rock Creek, C March–Nov.
nigriceps Em. Soldiers' Home, Department of Agriculture grounds, C April–June.
pallida Em. Rock Creek, C March.
persica Keys. Department of Agriculture grounds, Analostan Island, B June–July.
persoluta Cambr. Rock Creek, B March.
rostrata Em. Rock Creek, C March.
rubens Em. Rock Creek, C Oct.
spiralis Em. Potomac hills, Rock Creek, B March–June.
tibialis Em. Rock Creek, C Feb.
tridentatus. Rock Creek, B March.
viaria Blackw. Rock Creek, Soldiers' Home, D June–Nov.
zygia Keys. Department of Agriculture grounds, on trees, B June.

ORBITELARIÆ.

Fam. EPEIRIDÆ.

Acrosoma gracile Walck. D. C., in web, E July–Sept.
reduvianum Walck. D. C., in web, E July–Sept.
sagittatum Walck. Potomac hills, Cabin John's Bridge, in web, C Aug.

159. *Argiope cophinaria Walck.* D. C., in web, E June–Oct.
160. *argyraspis Walck.* D. C., in web, C June–Sept.
161. *Wixia ectypa Walck.* Potomac hills, Occoquan Falls, Zoological Park (in the ground), B May-June.
162. *Caxepalxis tuberculifera Walck.* Occoquan Falls, Ft. Washington, in web, B June.
163. *Mahadeva verrucosa Hz.* D. C., in web, D June–Sept.
164. *Ordgarius bisaccatus Em.* Department of Agriculture grounds, Potomac hills, C June–Aug.
165. *cornigerus Hz.* Department of Agriculture grounds, Bladensburg, Cabin John's Bridge, D June–Aug.
166. *Gea heptagon Hz.* Arlington, Va., A June.
167. *Epeira arabesca Walck.* D. C., D May–Oct.
168. *angulata Cl.* Ft. Washington, B Aug.
169. *benjamina Walck.* D. C., in web, E May–Oct.
170. *carbonaria L. Koch.* Potomac hills, near Chain Bridge, C May–Dec.
171. *conspicellata Walck.* D. C., E May–Dec.
172. *cornuta Clerk.* D. C., hibernating, E.
173. *displicata Hz.* D. C., D June–Oct.
174. *eustala Walck.* D. C., E April–Oct.
175. *folifera Marx.* Bladensburg, Potomac hills, C June–Sept.
176. *gibberosa Hz.* Potomac hills, Rock Creek, in web, D June–Aug.
177. *globosa Keys.* Potomac hills, Giesboro Point, Anacostia, B June–Aug.
178. *labyrinthea Hz.* D. C., in web, D May–Oct.
179. *maculata Keys.* D. C., C June–Aug.
180. *patagiata Cl.* D. C., D.
181. *placida Hz.* Potomac hills, Rock Creek, Great Falls, C June–Nov.
182. *pratensis Hz.* Potomac hills, Analostan Island, B June–Aug.
183. *sclopetaria Cl.* D. C., in web, E June–Oct.
184. *scutulata Hz.* Potomac hills, Rock Creek, Soldiers' Home, C June–July.
185. *stellata Hz.* D. C., D June–July.
186. *thaddeus Hz.* D. C., D May–Sept.
187. *trifolium Hz.* Potomac hills, Great Falls, in web, C June–Aug.
188. *volucripes Keys.* Potomac hills, B June.
189. *Cyclosa caroli Hz.* Potomac hills, tow-path to Alexandria, A June.
190. *turbinata Walck.* Potomac hills, Rock Creek, D May–Sept.
191. *Singa maculata Em.* Potomac hills, Rock Creek, C Mar.–Summer.
192. *maura Hz.* Potomac hills, near Chain Bridge, B June.
193. *pratensis Em.* Potomac hills, Analostan Island, C Sept.
194. *rubella Hz.* Potomac hills, tow-path to Alexandria, B Sept.
195. *variabilis Em.* Potomac hills, Rock Creek, C Mar.–Nov.
196. *Zilla notata Cl.* Potomac hills, near free bridge, B Aug.
197. *Argyroepeira hortorum Hz.* D. C., in horizontal web, E June–Oct.
198. *Theridiosoma radiosum McC.* Potomac hills, cascade, Rock Creek, near Pierce's mills, in web, C Jy.–Aug.

Fam. TETRAGNATHIDÆ.

199. *Tetragnatha elongata Linn.* D. C., in web, D July-Oct.
200. *extensa Linn.* D. C., in web, D July-Oct.
201. *fluviatilis Keys.* Giesboro Point, A July.
202. *laboriosa Hz.* Potomac hills, Great Falls, Fort Washington, C June-Sept.
203. *Eucta caudata Em.* Potomac hills, near Chain Bridge, B June.
204. *Eugnatha straminea Em.* Potomac hills, Rock Creek, Great Falls, C
205. *Pachygnatha furcillata Keys.* Potomac hills, Bladensburg, B March.
206. *tristriata C. K.* Potomac hills, Rock Creek, C Nov.
207. *xanthostoma C. K.* Potomac hills, Rock Creek, D Nov.-Dec.-Feb.

Fam. ULOBORIDÆ.

208. *Hyptiotes cavatus Hz.* D. C., D June-Dec.
209. *Uloborus americanus Walck.* Potomac hills, Rock Creek, D June-Oct.
210. *plumipes Lucas.* Potomac hills, near old fort, C June-July.

LATERIGRADÆ.

Fam. THOMISIDÆ.

211. *Xysticus emertonii Keys.* Potomac hills, near Chain Bridge, B Nov.
212. *feroculus Keys.* Potomac hills, Fort Washington, Bladensburg, C Aug.
213. *funestus Keys.* D. C., E May-Nov.
214. *gulosus Keys.* D. C., E May-Nov.
215. *limbatus Keys.* Potomac hills, D July.
216. *4-lineatus Keys.* Potomac hills, Rock Creek, C June-Sept.
217. *5-punctatus Keys.* Potomac hills, Bladensburg, Cabin John's Bridge, D Sept.
218. *sabulosus Koch.* Beltsville, Md., in pine woods, Gt. Falls, C Aug.
219. *stomachosus Koch.* Potomac hills, Rock Creek, C Sept.-Nov.
220. *triguttatus Koch.* D. C., male only, E June-Oct.
221. *Oxyptila monroensis Keys.* D. C., C July.
222. *Coriarachne versicolor Keys.* D. C.. E May-Nov.
223. *Synema bicolor Keys.* Giesboro Point, on Sycamore tree, B Aug.
224. *nigromaculata Keys.* D. C., D June-Oct.
225. *Misumena americana Keys.* Soldiers' Home, Potomac Hills, C May.
226. *dubia Keys.* Cabin John's Bridge, B June.
227. *georgiana Keys.* D. C., C May-Oct.
228. *mexicana Keys.* Cabin John's Bridge, B June.
229. *oblonga Keys.* Giesboro Point, in grass, B June-July.
230. *rosea Keys.* D. C., E May-Oct.
231. *vatia Cl.* D. C., E May-Sept.
232. *Runcinia aleatoria Hz.** D. C., E May-Oct.

* Runcinia brendelii Keys.=aleatoria Hentz.

233.	*Tmarus griseus Keys.* Cabin John's Bridge, on tree,	B	June.
234.	*Ebo latithorax Keys.* Glenwood Cemetery, Soldiers' Home,	C	Mar.-Jy.
235.	*Tibellus oblongus Walck.* D. C.,	D	June-Sept.
236.	*duttonii Hz.* Fort Washington,	B	June.
237.	*Thanatus rubicundus Keys.* Cabin John's Bridge, Soldiers' Home, Chain Bridge,	C	Sept.-Oct.
238.	*Philodromus aureolus Cl.* Glenwood Cemetery,	B	May.
239.	*clarus Keys.* Fort Washington,	D	June-Sept.
240.	*imbecillus Keys.* Giesboro Pt., Analostan Island,	D	June.
241.	*infuscatus Keys.* Potomac hills, Rock Creek, Soldiers' Home,	D	May-Oct.
242.	*keyserlingii Mx.* St. Elizabeth,	B	June.
243.	*marxii Keys.* Rock Creek,	B	Apr.
244.	*rufus Walck.* Cabin John's Bridge,	C	July.
245.	*vulgaris Hz.* D. C., in 1878–79, has almost entirely disappeared.		

CITIGRADÆ.

Fam. LYCOSIDÆ.

246.	*Dolomedes sexpunctatus Hz.* Potomac borders, Rock Creek,	D	Summer.
247.	*tenebrosus Hz.* Potomac borders, Rock Creek,	D	May-Sept.
248.	*urinator Hz.* Potomac borders, Rock Creek,	C	May-Sept.
249.	*Ocyale undata Hz.* Potomac hills, caught at night by sugaring trees,		May-June.
250.	*Trochosa cinerea Fabr.* Dept. of Agriculture, in hot-house,	A	Sept.
251.	*helvipes Keys.* Bladensburg,	B	Aug.
252.	*rubicunda Keys.* Giesboro Point,	B	June.
253.	*Lycosa arenicola Scudder.* Potomac hills, near old fort, Bladensburg,	D	Hibernating.
254.	*carolinensis Hz.* D. C.,	D	Apr.-Oct.
255.	*communis Em.* Potomac hills, Glenwood Cemetery.	C	June-Oct.
256.	*frondicola Em.* Cabin John's Bridge, Great Falls,	C	June-Aug.
257.	*kochii Em.* Potomac hills, Rock Creek.	D	May-Sept.
258.	*littoralis Hz.* Giesboro Point, Chain Bridge,	C	June-July.
259.	*maritima Hz.* Bladensburg,	C	June-July.
260.	*nidicola Em.* D. C.,	E	May-Sept.
261.	*nigroventris Em.* Rock Creek	C	
262.	*ocreata Hz.* Chain Bridge, Rock Creek,	C	June-Sept.
263.	*polita Em.* Potomac hills, Rock Creek,	C	June-Sept.
264.	*punctulata Hz.* Potomac hills, Cabin John's Bridge, Soldiers' Home,	C	July-Aug.
265.	*ruricola Hz.* Potomac hills, Bladensburg,	C	July-Aug.
266.	*scutulata Hz.* Potomac hills, Bladensburg, Soldiers' Home,	C	July-Aug.
267.	*tigrina McCook.* Potomac hills, near Chain Bridge, St. Elizabeth,	C	June-Aug.
268.	*Aulonia aurantiaca Em.* Rock Creek, nr. Catholic Univ.	C	Aug.-Sept.

269.	*Aulonia funerea Hz.* City, running on pavements,	R	July.
270.	*Pirata insularis Em.* Rock Creek,	R	May.
271.	*minuta Em.* Rock Creek,	C	Apr.
272.	*piratica Cl.* Soldiers' Home, Arlington,	C	Apr. July.
273.	*Pardosa albopatella Em.* D. C.,	D	Apr.
274.	*bilineata Em.* Rock Creek,	C	Apr.
275.	*brunnea Em.* Potomac hills, Rock Creek,	C	Apr.
276.	*lapidicola Em.* Rock Creek,	D	Apr. June.
277.	*montana Em.* Rock Creek,	D	Apr. July.
278.	*nigropalpis Em.* D. C.,	R	May June.

Fam. OXYOPIDÆ.

279.	*Oxyopes salticus Hz.* D. C.,	D	May Sept.
280.	*scalaris Hz.* D. C.,	R	May Sept.

SALTIGRADÆ.

Fam. ATTIDÆ.

281.	*Phidippus morsitans Walck.* D. C.,	R	Hibernating.
282.	*galathea Walck.* D. C.,	C	June July.
283.	*cardinalis Hz.* Fort Washington, Occoquan Falls,	R	June.
284.	*rufus Hz.* D. C.,	D	May Sept.
285.	*Philæus farneus Peckh.* Potomac hills, on tow-path to Alexandria,	C	May Aug.
286.	*militaris Hz.* D. C.,	D	May Oct.
287.	*Plexippus puerperus Hz.* Potomac hills,	C	May Sept.
288.	*Dendryphantes albomaculatus Peckh.* Cabin John's Bridge, on a fence,	A	July.
289.	*capitatus Hz.* D. C.,	D	June Oct.
290.	*elegans Hz.* Potomac hills, in pine wood,	R	Aug.
291.	*Icius palmarum Hz.* D. C.,	R	June Oct.
292.	*lineatus Ksl.* Analostan Island, Smithsonian grounds,	R	June Sept.
293.	*mitratus Hz.* D. C.,	D	May Oct.
294.	*Habrocestum peregrinum Peckh.* Rock Creek, Woodly Lane,	C	June.
295.	*cristatum Hz.*		
296.	*splendens Hz.* Soldiers' Home, Agr. grounds,	C	July Aug.
297.	*Saitis pulex Hz.* Soldiers' Home, Woodly Lane,	C	Sept. Oct.
298.	*Astia vittata Hz.* Giesboro Point, Analostan Island,	R	June.
299.	*Cyrba taeniola Hz.* Bladensburg,	R	Aug.
300.	*Neon nellii Peckh.*		
301.	*Prostheclina cambridgei Peckh.* Agr. grounds, Soldiers' Home,	R	June Sept.
302.	*Epiblemum scenicum Cl.* D. C.,	R	Hibernating.
303.	*Hyctia pikei Peckh.* Potomac hills, Rock Creek,	R	July.
304.	*Marptusa familiaris Hz.* D. C.,	C	May Oct.
305.	*Homalattus cyaneus Hz.* Bladensburg, Soldiers' Home,	C	June Aug.
306.	*Zygoballus bettini Peckh.* Soldiers' Home,	C	June.
307.	*Synemosyna formica Hz.* D. C.,	C	May Sept.
308.	*Synageles picata Hz.* Cabin John's Bridge, agricultural grounds,	R	June.

Discussion of the address followed by Messrs. Riley, Fernow, Marx, Schwarz, Smith, Dodge, Banks, and others.

FEBRUARY 5TH, 1891.

President Marx in the chair. Nine members present.

Messrs. Amory Austin and E. R. Tyler were elected active members of the Society.

Under General Notes, Mr. Schwarz exhibited samples of the fruit of *Solanum carolinense* which had been infested by a Tineid, probably *Gelechia beneficentella*, and said that this species seems to have been very abundant the past year in the vicinity of Washington. He asked whether this and other insects known to live in the fruit of *Solanum carolinense* had ever been observed to infest the fruit of the cultivated potato.

Prof. Riley said that he believed that the fruit of the cultivated potato was usually free from insect attack, and this was accounted for by the fact that the fruit of the wild *Solanum* spp. remains on the vines over winter, while in the case of the potato the vines are destroyed and the fruit with them. Prof. Riley also called attention to the fact that the potato fruits more abundantly in this country than in Europe.

Dr. Marx exhibited from his collection fourteen species of the genus *Pholcus* Walck., all of which had been found within the limits of the United States. He remarked that heretofore only two species had been known to inhabit this country, namely: *Pholcus phalangioides* F. (*Ph. atlanticus* Hentz.) and *Ph. pullulus* Hentz. (*Theridium pullulum*). Of the other twelve species two have been collected in Washington, D. C., one of which has been described by Keyserling as *Pholcus cornutus* (Neue Spinnen aus Amerika, 1887, No. 7). This very remarkable species bears a pair of thorn-like prominences upon the front side of the mandibles, and was found by the speaker in his cellar; the other species from the District of Columbia is yet undescribed, but has been found quite

frequently on fences and stone walls in the country. Three other species have been described as inhabiting other parts of the globe; one, *Pholcus tipuloides*, has been described by Koch in (Arachn. Australiens, p. 281). Dr. Marx, however, recognized the same amongst a number of Spiders from the Bermuda Islands (Proc. Nat. Acad. Sci. Phil., 1889). This species was collected by Mr. E. A. Schwarz at Biscayne Bay, Fla. Another species, *Pholcus gibbosus*, from Santa Fé de Bogota, has been described by Keyserling (Verh. d. Botan. Zool. Gesellsch. Wien, 1877). This species seems to be rather common in southern California and Arizona. The third species, which was collected in Arizona, Texas and New Mexico (Prof. Tyler Townsend, Las Cruces), seems to be closely related, if not identical with a species of Pholcus which Vinson collected at the Isle of Reunion, and named it Pholcus. Of the seven remaining species one was captured in State of Washington, one in Idaho, two came from South Dakota, two from California, and one from Arizona. Dr. Marx stated that he had a paper in preparation, giving descriptions and illustrations of all these species.

Mr. Schwarz exhibited specimens of *Casnonia ludoviciana*, found this winter in great abundance at the edge of the extensive swamp along the Eastern Branch of the Potomac within the city limits of Washington. The species was originally discovered by its describer, Mr. Aug. Sallé, in southern Louisiana, where it has subsequently been found by various entomologists, but always as a great rarity. In 1875 and in subsequent years it was found abundantly in Florida, especially in the Indian River country, occurring as far south as Biscayne Bay. Many years ago Mr. Ulke captured a single specimen near Washington, but this was thought to be an accidental importation from Florida. *C. pennsylvanica* occurs in dry and wet places, but *C. ludoviciana* lives exclusively in wet ground. The swamps along the Eastern Branch are inaccessible in summer time, and the beetle can only be found in winter, when it retires for hibernation upon drier ground. It will no doubt be found in similar localities all along the Atlantic Coast as far north as New Jersey.

Professor Riley laid before the Society an interesting card, which he had recently received from Mr. McLachlan, referring to the Blepharocerid larvæ mentioned at a previous meeting of the Society. Mr. McLachlan fully confirmed Professor Riley's reference of the larvæ in question.

Mr. Townsend read a paper on a "Remarkable New Hippoboscid," received from Dr. Alfredo Dugès, Guanajuato, Mexico, which had been taken on a bat. It was described as *Trichobius* n. g. *dugesii* n. sp.*

Mr. Townsend also presented a paper on a "Muscid bred from Swine Dung," which he described in its larval and imago states as *Cleigastra suisterci* n. sp.† This case of breeding had shown a larval hibernation, and Mr. Townsend expressed the belief that in more northern latitudes most coprophagous Diptera (*Hæmatobia*, *Lucilia*, etc.) winter equally as well as larvæ or pupæ and only exceptionally as perfect flies.

In the discussion Dr. Fox mentioned a curious instance of the hibernation of the house-fly in numbers about wasps.

Mr. Banks stated that he had found mosquitoes and gnats under bark in mid-winter in New York.

Mr. Schwarz said that winter collecting had not been much practiced, and a failure to find various flies during this season is simply because no careful search by Dipterists has been made.

Professor Riley mentioned that by means of the modern sleeping car the house-fly, even should it be destroyed by a severe winter in the North, would be introduced again in a very short time from the southern States. Professor Riley stated also that he had formerly done considerable early spring collecting and had found a large number of puparia in moist and sheltered situations, and hence it is known that many flies do hibernate in the puparium. He believed also that the larvæ of many species could be found during winter, and that these are hardy and can stand a considerable degree of cold. In reference to the house-fly he said that he had found the puparia in great numbers at his residence (Sun-

* See Canadian Entomologist, Vol. XXIII.

† See Canadian Entomologist, Vol. XXIII.

bury), but believes that under proper conditions the larvæ may also pass through the winter.

Mr. Schwarz presented the following:

NOTE ON PHYTOBIUS.

By E. A. Schwarz.

At a previous meeting of our Society (see Proceed. I, No. 2, pp. 75, 76) I exhibited a species of the Curculionid genus *Phytobius* found near Detroit, Mich. From a comparison with European specimens, which were given me as *Ph. velatus*, I had come to the conclusion that our species was different from that described by Dr. LeConte (Rhynchophora, p. 281) as *Ph. velatus*. Subsequently I discovered that my European specimens were incorrectly named, and that the specimens from Michigan perfectly agreed with Thomson's excellent description of that species (Scand. Col. VII, p. 232). Moreover, Dr. Horn upon a recent visit to Cambridge found that the Michigan specimens were specifically identical with the unique type in the LeConte collection.

Phytobius velatus is readily known among our *Ceutorhynchini* from its singular resemblance to the genus *Bagous*, which is not only exhibited in the structure of the tarsi but also in the form of the thorax which is almost square, and with the tubercles but feebly developed. In the best preserved specimens before me the median line and the sides of the thorax as well as the suture and the sides of the elytra are covered with sulphur-yellow scales, but this striking color is of an evanescent nature, and in most specimens these scales are dirty greenish-yellow.

A second North American Ceutorhynchid with narrow tarsi and very long claw-joint, and which must be referred to the genus *Phytobius* as defined by LeConte, is known to me and may be described as follows:

Phytobius griseomicans n. sp.—Form of body as in *Ceutorhynchus rapæ*, but transversely more convex and more rounded behind. Opaque, general color pitchy black, antennæ and legs, excepting the knees, reddish-yellow, apical edge of elytra reddish; upper surface densely covered with small closely-applied scales which form a water-proof covering, under side clothed with larger and less densely placed scales.

Beak a little longer than the thorax, gently curved, cylindrical, densely, finely punctulate, scales on upper side small and greyish, those on sides and under side larger and white. Antennæ inserted at the middle of the

beak, scape not attaining the eyes, funicle six-jointed, first joint much thicker than the following but not much longer than the second, joint 3 shorter than the second but longer than wide, joints 4 and 5 as long as wide, joint 6 slightly transverse, club rather small, elongate-oval, pointed. Head densely punctulate, flattened between the eyes, posteriorly slightly convex and with finely elevated median carina, scales on upper side small and glistening grey, those on the sides and under surface white. *Thorax* at base much wider than long, sides rapidly widening from apex to very near to the base, basal angles rectangular, base slightly sinuate each side, apical constriction short but well marked, apical tubercles nearly obsolete, posterior tubercles large and acute, disc densely and finely granulato-punctate, covered with brownish scales, median line broadly impressed and covered with ochreous scales; a vague transverse impression each side in front of posterior tubercles; scales on sides and under side whitish or ochreous. *Elytra* transversely convex, at base much wider than the thorax, shoulders well-marked but rounded, sides straight to beyond the middle, then narrowing, posteriorly declivous and separately rounded at apex; surface striate, striæ moderately broad and deep; interstices slightly convex, the third a little more elevated, the fifth at basal half much more prominent and subcarinate; surface densely covered with small greyish-black scales, which, when viewed from the side, show a beautiful greyish-white, velvety lustre; a large post-scutellar patch of whitish or ochreous scales, scales along the middle of lateral margin also whitish. *Pygidium* triangular, with a fine longitudinal median carina. *Under side* covered with large, round, yellowish-white scales; legs less densely clothed with smaller and more hair-like scales; tarsi as long as the tibiæ, without swimming hairs, third joint much shorter and hardly wider than the second, claw-joint fully as long as the rest of the tarsus.—Length, 2.2 mm.

Described from two specimens in Mr. Ulke's collection—one from Kansas, the other from Dakota.

In the specimen from Kansas there are a few whitish scales scattered among the dark scales of the elytral surface. The species is evidently closely allied to the European *Phytobius* (*Lithodactylus*) *leucogaster* but differs by its larger size, more convex form, the third tarsal joint being narrower and the elytral scales smaller and denser.

The more obvious characters, aside of coloration, size and form of body, distinguishing the two North American species, may be tabulated as follows:

Thorax almost as wide as long, sides straight from base to beyond the middle, posterior tubercles small and rounded; beak short and

thick ; fifth elytral interval not elevated ; tarsi with long, sparse swimming hairs...*velatus.*

Thorax at base much wider than long, sides strongly convergent anteriorly, posterior tubercles large and acute ; beak slender ; fifth elytral interval elevated at base ; tarsi without swimming hairs.*griseomicans.*

Referring to the cocoon of *Phytobius* previously mentioned by Mr. Schwarz, and also of other Coleoptera, Prof. Riley said that he would restrict the definition of "cocoon." He thought this term should not be applied to cells formed by the hollowing out of plant substances, such as the bud, stalk or crown of plants, or to cells made in the earth. The word cocoon he thought, should signify a *structure, i. e.*, something actually built up, either of silk, or some glutinous substance, or of welded or interwoven matter of any other kind. The others could be more properly termed cells or cradles.

Mr. Schwarz presented the following note :

A CORRECTION.

By E. A. Schwarz.

On a former occasion (see Vol. I, pp. 163, 164), I referred a species of *Pityophthorus* bred from Liquidambar twigs to *P. annectens* Lec. Having subsequently procured males of the latter species I see now that I was mistaken in my determination, and that *P. annectens* is quite different from the species boring in Liquidambar. The latter is identical with what I consider to be *P. consimilis*, which is also known to live in various species of Sumac. The females of the two species resemble each other so closely that they can hardly be distinguished, but the males are readily distinguished by the nature of the pubescence of the head. In the male of *P. annectens* the pubescence is yellow, very long, forming a circular fringe and usually concealing the sculpture of the head. In the male of *P. consimilis* the pubescence is much shorter, of grayish color, sparse anteriorly and more brush-like on the posterior part of the head. I have very little doubt that even Dr. LeConte in his letter addressed to Dr. Packard (see Bull. No. 7, U. S. Ent. Comm., pp. 260, 261) has also confounded the females of the two species, and fully believe now that *P. annectens* will prove to live exclusively on *Pinus palustris* and allied species of the same genus.

The genus *Pityophthorus* is, in our fauna, the largest as well as the most difficult genus of Scolytids. The species having

the elytral declivity dissimilar in the two sexes (*P. carinulatus*, *pullus*, *plagiatus*, etc.) should, in all probability, be removed from this genus and placed near *Tomicus*. *P. minutissimus* and allied species form another well-defined group which could easily be elevated to the rank of a subgenus. The remaining species, still very numerous, are very homogeneous in structure and can be distinguished with certainty only by the secondary male characters, as exhibited in the sculpture or pubescence of the head. Very often even the determination of the males is rendered very difficult without dissection, because in many cabinet specimens the head is retracted within the thorax and entirely concealed from view. To obviate this difficulty it will be advantageous, I think, to use chloroform or acetic ether in killing the specimens instead of cyanide of potassium.

MARCH 5, 1891.

President Marx in the chair. Nine members and two visitors present.

Mr. Schwarz was elected to the position of Corresponding Secretary made vacant by the departure of Mr. Townsend, who had been called from the city to take the position of Entomologist in the New Mexico Agricultural College.

Mr. Fernow was elected a member of the Executive Committee vice Mr. Schwarz, resigned.

Mr. Banks called attention to specimens of *Scolopendrella*, *Machilis* and *Lepisma*, in different stages, taken this winter in Rock Creek Valley, D. C.

Two papers by Prof. Riley were read in his absence, the first being as follows:

NOTE ON THE LIFE HABITS OF MEGILLA MACULATA.

BY C. V. RILEY.

In accordance with my promise at a previous meeting (September 4, 1890,) I present herewith a comparative description, with specimens, of the larva of *Megilla maculata*, simply because it furnishes another illustration of a very common insect that has never been described or figured in its adolescent states. I have had the larvæ, obtained at St. Louis, ever since 1870, where they were found abundantly in connection with the adult

upon maize. In 1872 I also reared the beetle from pupæ found on Croton. We have long known that the imago in this species departed from the normal habits of the family, in that it feeds upon various substances and approaches more nearly in this respect the genus Epilachna. Its food habits have been pretty well investigated and recorded by Forbes (12th Illinois Entomological Report, 1883), and it was found devouring the pollen of *Taraxacum densleonis* by Mr. Webster (American Entomologist, Vol. III, 1880, p. 173), while I have recorded its injury to blades of corn and its eating the eggs, larvæ and pupæ of *Lina scripta* (American Naturalist, 1881, p. 326). I have also shown in the same periodical for 1883, pp. 322, 323 that the beetles in confinement did not eat various kinds of leaves offered them. They have, however, been found eating into the soft kernels of corn, and quite extensively by Mr. Pergande in some observations he made on corn insects for me. He found both adults and larvæ eating into the soft kernels of sugar corn. Mr. Webster has also found both the imago and larvæ of *Diplosis tritici* and the imago on the wheat blossom. So many insects belonging to genera or families which are essentially plant feeders will also feed upon soft insects and *vice versa*, that this combined habit in the adult *Megilla* is not so strange as would at first appear, and there is, so far as I know, no evidence to show that the larva is ever anything else than entomophagous.

The larva of *Megilla maculata* closely resembles that of *M. 13-punctata*, for which it might easily be mistaken. That of *13-punctata* is, however, paler, with black markings of the prothorax distinctly bi-lobed posteriorly, whereas in *maculata* the posterior margin is entire. It also closely resembles the larva of *Coccinella bipunctata*, the tuberculation and thoracic markings of which are almost identical, though the general color is darker, more dingy and without the bright band across the fourth abdominal segment. The larva of *C. 9-notata* is also very similar, but the hairs of the tubercles are distinctly enlarged and not simple as in *maculata*. In the markings of the pro-thorax the larva of *maculata* is almost identical with that of *C. bipunctata*.

Mr. Schwarz remarked that the life histories of our Coccinellidæ do not seem to present any special features, and the only peculiarity in *Megilla maculata* that occurred to him was the habit of congregating or huddling together in great numbers under stone, bark, boards, etc., during cold weather, not only in winter-time, but also in spring and summer. The

species also seem to be more numerous on plants growing in swamps than on those growing on dry land. The wide geographical range of this beetle was also pointed out, as well as the fact that in the more northern climates it is remarkably constant in coloration, but quite variable in more southern latitudes.

Mr. H. W. Turner stated that he had seen in California a Coccinellid, probably *Megilla vittigera*, which likewise congregates in enormous numbers.

Mr. Howard said that Mr. C. D. Walcott at a recent meeting of the Biological Society of Washington had called attention to the congregation in large numbers of a lady bird (probably *Hippodamia convergens*) on rocks just at the snow line in the Rocky mountains. Mr. Schwarz replied that this should not be considered as a voluntary congregation; the beetles were carried upwards by ascending currents of air along the slope of the mountain and falling upon the snow fields either perished from cold or managed to reach rocks or other objects projecting from the snow. While in Colorado he had seen at an altitude of about 12,000 feet the snow fields thickly covered with such multitudes of *Phyllotreta pusilla* and *Hippodamia convergens* that the glare from the snow, otherwise so trying to the eyes, was perceptibly diminished.

Mr. Mann said that he had not been able to get *Coccinella bipunctata* to feed indoors in winter-time on Aphides, and that this species did not occur very abundantly in houses.

Prof. Riley's second paper was as follows:

ON THE LARVA AND SOME PECULIARITIES OF THE COCOON OF SPHECIUS SPECIOSUS.

By C. V. Riley.

In elaboration of some former remarks on the life-history of *Sphecius speciosus* made at the meeting for September 4, 1890, I wish to submit a more detailed description of the larva, and at the same time to draw attention to a remarkable peculiarity of the cocoon. The larva in form, color and general appearance resembles the typical larvæ of the fossorial wasps, so far as we already know them. It possesses great extensile and contractile power, the anterior segments, more particularly,

having great power of elongation, so that in life and when feeding it reminds one of some great Syrphid larva. When at rest, with the head bent over on the breast, it measures at full growth about one and one-eighth inches to two inches. The skin is nearly smooth, but with a slight rugosity and flecked more or less with whitish spots, especially between the segments. There are ten pairs of reddish-brown spiracles, one for each segment from the first to the tenth. The head is resinous in color, and the mouth-parts are remarkably well-developed as compared with other aculeate hymenopterous larvæ. The clypeus, labrum, mandibles, maxillæ and labium are quite as prominent and perfect as in many Coleopterous larvæ. The mandibles are very strong, somewhat obtusely pointed, and have, a short distance below the apex, a prominent tooth. They are dark brown, almost black at tip, paler at the base. The maxillæ are large, fleshy organs, terminating in two brownish horny processes, one of which doubtless represents the maxillary palpus. The labium is also a fleshy organ and bears two horny processes representing the lingula. It has also a spinneret. The antennæ are very rudimentary and are represented by two minute whitish elevations on the front.

The cocoon is constructed very rapidly, not more than two days being required for this purpose. Irregular threads are first thrown out and attached to whatever they may touch—both the Cicada and the surrounding wall of the cell. The cocoon, which at first consists of an open cylinder, is constructed of silk, with enough earth incorporated to make a rather dense pod, and is of an irregular elongate-ovoid form, tapering somewhat toward the posterior end, and varying in length from one and one-half to three-quarters inches. The interior is loosely lined with a coarse yellow silk, except for an area in the middle, covering from one-half to two-thirds of its inner circumference, where it is densely covered with a fine white silk. In this light area, and covered by the silk, are to be seen from eight to twenty dark-brown slightly elevated spots. These spots are caused by a resin-like substance employed to cap certain very anomalous hollow tubercles which project from and open on the exterior of the cocoon. These tubercles are constructed of the same resin-like brownish substance, and in their perfect form and size greatly resemble spiracles. They are capped, as described, evidently after the completion of the cocoon. These curious little tubes I have not noticed in the cocoons of any other sand or fossorial wasp, and their purpose is somewhat problematical. My first impression was that they were little pellets of excrement, being the last fæces excreted by the larva about the time of completing its cocoon, and that, having viscid and solvent qualities, they had

penetrated the walls of the cocoon and from the inside had been covered up with a new lining of silk by the larva in order to prevent moulding or the access of moisture from the surrounding earth. But a more careful examination shows them to be too perfectly tubular and too uniform to fully justify this explanation, and I am forced to the conclusion that they are made purposely by the larva, doubtless by the labium, and that they are intended for some special purpose, possible of ventilation and respiration. This hypothesis brings up the interesting general question, so far as it relates to insects, of the need of ventilation in the cocoons or other protective retreats in which they hibernate and undergo their transformations. It is a most interesting question, which I cannot discuss at length in this connection.

Mr. Mann stated in the discussion of this paper that Trouvelot had tried the experiment of shellacking the cocoon of Bombycids without any difficulty in breeding therefrom. General discussion followed on the breathing of larvæ and pupæ especially in the case of sub-aquatic Coleoptera.

Mr. Fernow presented a paper on *Psilura monacha*, of which he has furnished the following abstract:

THE RAVAGES OF LIPARIS (PSILURA) MONACHA IN GERMANY AND MEANS OF DEFENSE.*

By B. E. Fernow.

[Author's Abstract.]

Mr. Fernow spoke of the alarming increase of *Liparis monacha* in Germany, and especially Bavaria, during the last year, and the anticipations of still greater damage in 1892, and hence the diligent search after effectual remedies. He pointed out that such ravages in German pine and spruce forests meant not only many thousands of dollars loss in depreciation of wood values, but also most inconvenient disarrangement of working plans, which are necessarily laid for 100 or more years in advance. He brought forward further statistics to show the significance of the pest, and then described such life habits as

*See *Insect Life*, Vol. III, pp. 379–82, for full author's abstract of this article.

were suggestive of remedies. Among these the great mobility of the larva and the tendency to migration of the imago were most prominent.

Various methods of checking the ravages have been proposed and practiced. The sweeping and collecting of larvæ are found ineffective on account of numbers, and undesirable because enemies are destroyed at the same time; gathering of eggs, because all over the tree, high up, and difficult to get at; collecting pupæ, too few on the ground; breeding of *Tachina monachæ*, too difficult and uncertain. Ditches have been found a good aid to check migration of the larvæ and confine it. One of the most ingenious but costly and ineffective propositions has been the steam and electric exhauster, the invention of a socialist, an illustration of which was shown and described.

The most effective remedy had been demonstrated by a trial over 2,000 acres and at an expenditure of $12,000, including the cutting of infested trees, etc., to be an application of a glue, to which Mr. Fernow gave the name "Insect Lime" (from analogy to bird lime). This material has long been used against a number of other insects, among which the gypsy moth. The mobility of the young larvæ, which although hatching all along the trunks to the top, are apt in windy or rainy weather, or when the food supply on the tree becomes scant, to let themselves drop, suggested to prevent their reascent by applying a band of insect lime, which has been found absolutely effective, the larvæ being starved to death.

Particulars as to the nature, method of application and cost of the remedy were given, and its introduction as a cheap means of protecting orchard and park trees against a number of depredators was suggested.

In answer to a question by Mr. Howard, Mr. Fernow said that the lime referred to in his communication could be imported, and if stored in covered barrels would keep for a considerable period. It would cost about $2 per 200 pounds.

Mr. Howard called attention to the fact that this and other European moths were subject to the attacks of an immense number of parasites as compared with allied American species, and gave the following data of parasites of several important European moths: *Gastropacha neustria*, 60; *Ocneria dispar*, 28; *Psilura monacha*, 21; *Lasiocampa pini*, 55; and *Laria leucoma*, 32. He said also that the great increase of *Psilura monacha*

the past year was possibly explained by the fact of the occurrence of a wet season, which was inimical to the increase of parasites.

Mr. Schwarz said that Mr. Fernow deserved the thanks of the Society for calling attention to a very valuable, and by Americans seldom consulted, source of entomological information, viz., the forestry journals of Europe, and particularly of Germany and Austria.

Mr. Howard said in regard to the work in Europe against insects, that in the matter of insecticide machinery France took the lead, and that in means of controlling plant lice and Coccids Italy ranked first.

Mr. Schwarz called attention to the concerted action against insects in Europe by means of which many very simple measures are successful which, in this country, for lack of general application and combined action, are a failure.

APRIL 2, 1891.

Vice-President C. V. Riley in the chair. Eleven members and two visitors present.

The Publication Committee reported the issuance on this date of No. 1 of Vol. II of the Proceedings, and presented a number of copies for the inspection of the Society. A copy was ordered sent to each of the scientific societies of Washington.

The President announced the sudden death of the recently elected member, Mr. E. R. Tyler, and appropriate action was taken by the Society.

Mr. Banks presented the following paper:

MIMICRY IN SPIDERS.

By NATHAN BANKS.

The cases of mimicry in the spiders of the United States may be arranged in two groups, and, in fact, are so grouped naturally. One group comprises the mimicking Drassidæ; the other the mimicking Attidæ. While the latter group stands at the head of the spiders, the former is near to the bottom of

series. Both mimic ants, and so it is interesting to compare these two groups of cases and see how nature has arrived at similar results by using different paths. The mimicking Attidæ belong to the genera *Salticus*, *Synageles* and *Synemosyna*. The mimicking Drassidæ belong to two genera which are somewhat widely separated, one in the Drassinæ, *Micaria;* the other in the Clubioninæ, *Thargalia*. Of the five genera mentioned, *Synemosyna* and *Micaria* most closely resemble ants.

On comparing a Drassid with an Attid one will notice very striking differences of important structures; differences which have led to their wide separation in modern classifications of spiders. Yet these differences are masked and covered by certain resemblances which are of no important value for classification, but which nature has found admirably suited for the deceptions she wishes to produce. They are both ground spiders wandering for their prey; this is a necessary habit in order that they may mimic ants. The plan of markings on the abdomen consists, in both groups, of transverse bands; in each of these families there are, of course, plenty of exceptions. But throughout the higher genera of the Attidæ one can trace quite accurately a tendency for transverse markings. The exceptions are found in the lower genera, *Marptusa*, *Menemerus*, *Icius*. This style of markings is also the predominating one in the Drassidæ.

There is one great difficulty to overcome in the mimicking of an ant by a spider; that is, in the former the body is divided into three portions, while in the latter it is composed of two. But nature can overcome this by contracting the abdomen of the spider, and in many cases this is done; but she can also deceive the eye by color. Given the tendency for transverse markings, it is easy for a transverse interrupted white band to be developed on the abdomen so as to give the appearance of a contraction; this is especially deceiving when it is developed in connection with, and at the same place, as a slight constriction. Two or more bands may be present and this tends to destroy the real contour of the body and to make it look narrower.

In *Synemosyna formica* the deception may be said to be perfected. Usually blackish at each end and slightly reddish in the middle; a constriction near middle of the cephalothorax and another on the front half of the abdomen; at each constriction an interrupted light band, slender light-colored legs. Sometimes the spider is almost wholly reddish-yellow. Its habits are not very much like an ant; it is quite slow and deliberate. *Synageles* lacks the cephalic constriction and the abdomen is broader, yet it resembles an ant very closely. It is very active and its movements supply what it lacks in structure. *Salticus* does not structurally so closely resemble ants, yet there

is an approach to it; its motions are very illusive. In *Micaria* the cephalothorax is elongated, but not constricted; the abdomen has a slight constriction near the front end. The legs are very long and slender. But the best effect is produced by its scales, most beautifully iridescent. A white band sometimes interrupted is at the constriction—sometimes another behind this one. I have seen *M. longipes* running on the ground near ants of similar size, though it was more often seen alone. Another species of *Micaria* I took on the flowers of a Solidago among ants of the same size, and in my net both ran around in the same manner. The *Micaria* seemed a little over-anxious. Though *Thargalia* has not been modified in structure as much as the other forms, its mimicry of an ant is extremely close. In central New York there is a black species with one white band which lives among the large black ants that are common under leaves in the woods. The *Thargalia* is of the same size, when adult, and its movements are quite similar. In Texas I have seen another species of *Thargalia* which mimics the "Agricultural Ants" that are common on the ground in that locality. It is of the same red color, is of the same size, when adult, and can move as rapidly and irregularly as the ant. Several times have I seen it in "ant clearings," and it was not disturbed by the sagacious inhabitants.

I have never yet seen any of these spiders eating ants, and I do not believe that they do, for an ant has a pretty hard skin for a spider to bite through. Their mimicry is of the most value to them as a protection. Thus, in review, one sees that these forms have not had any of their important characters modified for the purpose of deception, but similar results have been reached by modifications of some unimportant parts. The deception is superficial, they remain good at heart.

Mr. Schwarz remarked that *Thargalia* resembled ants, and since on Mr. Banks' statement it was found only in company with these insects, it may be considered as truly myrmecophilous, deriving more benefit from the ants than is implied in the term protective-mimicry.

In answer to a question by Mr. Howard, Mr. Banks stated that the resemblance of these spiders to ants was not especially protective, although it may protect them from the attacks of wasps. The benefit probably comes in enabling them to more easily approach and seize their prey.

Prof. Riley stated that he doubted if they could be termed myrmecophilous, since they did not get their prey with the ants; and also that their resemblance to the ants was hardly mimetic because no or little advantage results, and mimicry is always of a protective significance.

Prof. Riley presented a note on the life history of the *Diabrotica 12 punctata** which was called forth by a recent paper in *Psyche* on the insect by Mr. H. Garman. He first referred to an article on the food habits of the beetle, in Vol. I, p. 59 of *Insect Life*, in which by a typographical error the insect is stated to have "bred" upon melons instead of "fed" upon melons, the first statement being justly called in question by Mr. Garman.

He followed with a record of his notes on the corn-feeding habit of the larva of this insect, which was first brought to his attention in the spring of 1883. During this year and in 1884 and in 1886, he had succeeded in bringing together a full record of the larval habits, an account of which was given. Figures of the egg, larva, pupa, adult insect and nature of the injury to young corn were exhibited, and descriptions of all stages were given.

Two dipterous parasites were referred to, one obtained from the larva and the other coming from the adult.

In the discussion Mr. Schwarz remarked that the history of this insect presents a very interesting but not unusual experience, viz., that a certain species may live year after year in the neighborhood of cultivated plants without doing injury, and then suddenly develop an extremely injurious habit. He believed that the wild food-plants would be found to be numerous.

Prof. Riley held that the fact that it is now injurious does not argue that the habit is of recent formation, although the presumption is always strong that this is the case, especially in view of the attention hitherto paid to corn insects.

Mr. Kuehling said that ten years since he had known young corn to be destroyed by probably the same insect near Mt. Vernon, Va.

Prof. Riley then presented the following communication:

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* Published in full in *Insect Life*, Vol. III.

MEXICAN JUMPING BEAN.

The Determination of the Plant.

BY C. V. RILEY.

In the Transactions of the St. Louis Academy of Science for December, 1875, Vol. III, page CXLI, I gave some account of *Carpocapsa saltitans* Westwood, and the manner in which it produces the motions of the well-known Mexican Jumping Seed or "Devil's Bean," and I there called attention to the fact that the particular Euphorbiaceous plant, upon which these seeds occur, was not known or determined. The poisonous nature of the plant, and the fact that it is used by the Indians to poison their arrow-points, have long been known, and, in fact, the plant is called Arrow Weed (*Yerba de flécha*) by the Mexicans. The shrub was described to me in a letter from Mr. G. W. Barnes, then President of the San Diego Soc. Nat. Hist., in 1874, as small, branchy, from four to five feet in height, bearing in the months of June and July seeds, a pod containing from three to five. The leaf was described by Mr. Barnes as resembling that of Garambullo, being one-half inch in length and one-quarter inch in width, a little more or less. He described the bark as ash-colored and the leaf as perfectly green during all seasons, and stated that it bore seed only once in two years. In a later letter he stated that, according to his information, it grew only in the region of Mamos in Sonora; that it is called Brincador (Jumper), and the seeds "Brincaderos." Westwood, in his original description of *Carpocapsa saltitans*, states that the plant is known by the Mexicans as *Colliguaja*, and my old friend, Prof. E. P. Cox, informed me some years ago that the shrub has a wood something like the Hazel or Wahoo, and that the leaf is like a broad and short willow leaf. He confirmed the statements as to its poisonous character and its use to poison the arrow-heads of the Indians, and said that a stick of the shrub, when used to stir the "Penola" of the natives (ground corn meal parched), purges. I have taken every occasion possible during the last fourteen or fifteen years to endeavor to get specimens of this particular plant, with the view of having it accurately determined, and I was very much gratified, therefore, in receiving last November from M. P. Chrétien, a member of the French Entomological Society, an interesting communication in which, in asking for copies of my articles upon this insect, he referred to his own rearing of it, and to the plant as a Mexican Euphorbiaceous plant by the name of *Colliguaja odorifera* Moline, which is a synonym of *Croton colliguaja* Sprengel. This letter

was still on my desk when Mr. J. M. Rose, of the Botanical Division, brought me specimens of plants which had recently been collected by Dr. Edw. Palmer, who, with the plants, sent specimens of the capsules, thus rendering it quite certain that the "Jumping Bean" occurs on this particular plant. It turns out to be undescribed, and has been finally referred to the genus *Sebastiania*, and Mr. Rose intends to describe it as *S. palmeri*. Naturally, as in so many Euphorbiaceous seeds, the carpel splits into two parts in dehiscing, but when infested with the Carpocapsa larva the silk lining which the latter spins prevents the seed from dehiscing. The general aspect of the leaf is not unlike that of a broad-leafed willow, the length varying from one to three inches, and the width from about one-half to one and one-quarter inches. The reference given by M. Chrétien in his letter would appear to be erroneous. At all events, Bentham and Hooker give *Colliguaja odorifera* as from South America, and I can find no record of its occurring in Mexico. Comparison of the specimens in the Department herbarium shows that, while evidently allied, *Colliguaja* is quite distinct from *Sebastiania*, which fact renders it rather remarkable that the name given by the Mexicans to the plant should be identical with that adopted for the genus of a South American plant, and the inference may properly be drawn that this name is applied by the inhabitants indifferently to various Euphorbiaceous species which occur, whether in Mexico or south of the Equator.

If *Colliguaja* does occur in Mexico and is also a host of *Carpocapsa saltitans*, it may readily be distinguished from the species of *Sebastiania* here mentioned by its small, thickish leaves, which are strongly glandular-toothed ; the male flowers form long slender spikes, with very many stamens. The capsule is described as nearly one inch broad.

A closely allied species of *Sebastiania*, coming from the same localities, and also yet undescribed (but which Mr. Watson intends to describe as *Sebastiania pringlei*) and which has previously been referred to the genus *Gymnanthes*, also shows evidence of being infested with Carpocapsa, and indeed an esteemed correspondent, M. Eugène Dugès, of Guanajuato, Mexico, has reared the moth from the capsules of this particular species. Still a third species (*S. bilocularis* Watson) is interesting because the capsules are bi-coccous instead of tri-coccous, and the capsule is withal much smaller and more rounded.

It is also infested by a larva which, if not the same, is closely allied to that of *Carpocapsa saltitans*. A single moth was obtained by Mr. Rose, but was lost, so that I have not been able to examine it. So far as its general appearance is concerned,

however, Mr. Rose thinks it showed close resemblance, although smaller, to that produced from the seeds of *S. palmeri*.

There is, therefore, good evidence that the insect develops in the capsules of several different species of the genus *Sebastiania*, if not in those of other closely-allied genera. The plants differ not only in the general appearance and foliage, but in the inflorescence and seed, and the following synopsis, prepared for me by Mr. Rose, will prove interesting:

SEBASTIANIA.—A large genus of Euphorbiaceæ, of some forty species, confined mostly to South America; mostly shrubs; rarely herbs; leaves alternate, entire or slightly toothed; flowers monœcious; the male flowers forming slender terminal spikes at the base of which are 2 or 3 female flowers; female flowers with small bract-like calyx, 3 to 5-parted; fruit a capsule, globular or 3-lobed; the capsule separates in age into 3 cocci each of which contains one small seed which more or less fills the cavity.

Sebastiania bilocularis Watson.—(Proc. Amer. Acad. XX, 374, 1885). A shrub 1 to 2 feet high with upright slender branches, glabrous and with light-gray bark; leaves linear-oblong or narrowly lanceolate, 1 to 2 inches long, obtuse to acuminate, abruptly cuneate at base, obscurely glandular toothed; ovary two-celled, with two stout revolute stigmas; capsule broadly ovate, acute, bi-coccous, about 5 lines long; seed sub-globose, 3 lines broad.

It grows in dry water courses on the hills and mountains of Northwestern Sonora, and has been reported from Lower California.

Sebastiania palmeri Rose n. sp. ined.—A loose-growing shrub, 5 to 8 feet high, or even sometimes 10 feet high, glabrous, with reddish bark; leaves narrowly-lanceolate to lanceolate, 2½ to 4 inches long, slightly dentate; ovary 3-celled, with 3 spreading slightly united styles; capsule oval, obtuse, 3-celled, 3 lines in diameter.

Collected in various places in the mountains about Alamos, Sonora, by Dr. Palmer in 1890.

Sebastiania pringlei Watson n. sp. ined.—A small shrub with spreading branches and brownish bark; leaves lanceolate 1 to 3 inches long, acuminate, obtuse at base, minutely toothed; ovary 3-celled, with spreading slightly united styles.

Collected by Pringle in San Luis Potosi, and in Sonora by Dugès in 1890.

It is difficult to say which of the species Mr. Barnes referred to in his letter from which I have already quoted, but the reference to the seed is somewhat misleading, and the refererence to the pod containing from three to five seeds is also somewhat ambiguous and probably erroneous. Each of the carpels contains one seed, which, when the fruit is young in all probability fills up the entire space and the young Carpocapsa larva doubtless hatches from an egg laid externally on the capsule and penetrates the same while it is yet quite young, eating into the true seed very much as in the case of the larva of the common Pea Weevil (*Bruchus pisi*.) The plant described by Prof. Cox, whom I have quoted, corresponds fairly well with *S. pringlei*. Dr. Palmer found that *S. palmeri*

was limited in its distribution to certain cañons about Alamos. He states that it is known as the *Palo de la flécha, cuero de las simellas, brincaderos*, (Arrow tree which produces the jumping bean). The plant exudes a good deal of milky juice, which is what the Indians use on their arrow heads. He found the plant in several places, but it is reported that the "jumping beans" are found only in an *arroya* near Alamos. It is not easy to obtain the infested capsules, because boys are always on the lookout for them and gather them for sale, as they find a ready market. He describes the shrub as a loose-growing plant, five to eight feet high, the wood very hard, and the milky juice readily crystallizing into a clear white brittle substance.

Professor Riley also called the attention of the Society to some interesting anomalies in the following species. They are two Noctuids, both from the same locality and both from a rather small collection recently received, which show a shortening of the wings on one side (the left) of the body. The species are *Agrotis placida* Grote and *Agrotis introferens* Grote. In neither of these species is there anything to show that this is due to gynandromorphism, as they are both females, with no indication of male character on one side. The deformity or aberration is undoubtedly due to chance.

The other case is more interesting. It is a remarkable bifurcation of the terminal joint of the left antenna in a specimen of the common Cerambycid *Tragidion armatum*. The bifurcation is from the base of the joint, and in fact, the abnormal growth has all the appearance of a thumb growing out from the base of the terminal joint, the thumb being somewhat longer than the joint itself.

Mr. Schwarz remarked in answer to an inquiry by Mr. Mann that bifurcation of the antenna was not infrequent in Coleoptera and may be of a single joint only, as in the specimens exhibited, or of the entire antenna.

Mr. Schwarz presented the following paper:

NOTE ON THE FOOD-HABITS OF SOME HALTICIDS.

By E. A. Schwarz.

The North American *Halticini* were not monographed until the year 1889, when Dr. Horn published his excellent "Synopsis of the Halticini of Boreal America." Prior to that date we had, in the more intricate genera, only isolated descriptions from which an accurate determination was, in most instances, not possible, the result being that not only our collections were full of wrong determinations or undetermined specimens, but that such erroneous determinations were also published in faunal lists or records of food-habits. Since many Halticids are of greater or smaller economic importance, it is certainly desirable to know whether or not the published records of food-habit, life-history, etc., are reliable, *i. e.*, based upon correct determination of species. I have thought it worth while to briefly review those of the more important records to which I have access in my private library. In the absence of typical specimens I am, of course, unable, in most instances, to correct the records, and my only object is to point out where, in my opinion, the determinations are open to doubt and to recommend that such doubtful records should not be used in future unless they be verified by renewed observation or by examination of the typical specimens. Those species, the records of which appear to be based on correct determination, are not mentioned in the following notes.

In speaking of the food-plants of Halticids (and of many other phytophagous Coleoptera) we must discriminate between the food-plants of the larva and those of the imago. In many species the imagos feed, often in vast number of specimens, on a variety of plants which are not the food-plants of the larva, and it may be said that, as a rule, the imagos are by far more polyphagous than the larvæ. The true food-plant of a species is, of course, that upon which the larva feeds. Some observers have failed to make this discrimination and give, in many instances, a certain plant as the food-plant of a species whereas, in reality, they mention only one of the food-plants of the imago.

Disonycha pennsylvanica and *quinquevittata* and their varieties were formerly often confounded, the large and pale varieties of the former species, with feeble or obsolete elytral sulci, being more especially the cause of confusion. Thus the records of the food-habits of the two species are by no means reliable. The larva of *D. pennsylvanica* undoubtedly feeds on various species of *Polygonum* and *Rumex*, and the imagos occur and feed also on *Salix*, but whether the larva also feeds on the latter plant is still somewhat doubtful. Mr. Bruner states

(Bull. 14, Exper. Stat. Nebr., 1890, p. 111) that the larvæ are common on *Salix*, but they have not been bred and may belong to *D. 5-vittata*. That the real food-plant of the latter species is *Salix* was first proven by Walsh (Proc. Ent. Soc. Phil. III, pp. 404, 405; l. c. VI, p. 270). Various other records of these two species refer apparently only to the food-habit of the imago.

D. caroliniana. Whether Mr. W. H. Harrington's statement (Can. Ent. XVI, 1884, p. 97) that this species feeds abundantly on *Rumex verticillatus* refers to the imago only, or also to the larva is uncertain. Nor is it certain that he had the true *D. caroliniana* before him.

Haltica chalybea. All references to this species as a grape-vine pest in the eastern United States are no doubt correct, while those from the Southwest and the Pacific slope are, to say the least, open to doubt.

Some uncertainty prevails regarding other food-plants of the larva. That the latter lives on *Alnus serrulata* seems to be certain, but its occurrence on *Ulmus* and *Prunus* is doubtful, and these latter records refer probably only to the imago. The species must have still another true food-plant since the imagos are abundant on various trees in the semi-tropical hammock of Florida, where *Vitis, Alnus*, etc., do not occur. The imago was found by me in great numbers on *Carpinus* at Ft. Pendleton, Md., but no larvæ were seen among them.

H. ignita. This variable species has often been incorrectly determined in former times, and the bright æneous or copper-colored varieties were usually named *H. carinata* in collections. Most of the references to the latter species should therefore be transferred to *ignita*. The imago appears to be more polyphagous than any other species of this genus. The food-plants recorded are: *Kalmia latifolia*, *K. glauca*, *Œnothera biennis*, *Erechthites hieracifolia*, *Vitis* (?), cultivated strawberries and cultivated Fuchias. Quite a number of other plants could be added to these, but how many of them are the food-plants of the larva remains doubtful. The larvæ have been bred from *Œnothera biennis* by Prof. Riley (Amer. Ent. III, p. 200), and this seems to be the only true food-plant ascertained so far.

H. carinata. From the geographical distribution as given by Dr. Horn it is evident that all references to this species from the more southern portion of the Atlantic slope are based upon incorrect determination and should be referred to some other species, probably always *H. ignita*. Mr. W. L. Devereaux (5th Rep. U. S. Ent. Comm. p. 276) gives *Ulmus* as the food-plant, but since he describes the imago as being "of a greenish hue" there is considerable doubt as to correct determination. Dr. Horn (Trans. Amer. Ent. Soc. XVI, 1889, p. 223) states upon authority of Mr. D. W. Coquillett that this

species injures the grapevines at Los Angeles, Cal., but this record probably refers only to the feeding habit of the imago.

H. foliacea and *punctipennis*. There is undoubtedly some confusion in the references to these closely allied species which can be unraveled only by examination of the typical specimens. The species injurious (both as larva and imago) to apple trees in Kansas, Nebraska and Missouri, and variously referred to as *H. foliacea* or *punctipennis* is in all probability *punctipennis*. *H. foliacea* is stated by Dr. Horn to injure the grapevine. *Gaura parvifolia* and other *Onagraceæ* (Popenoe) and *Cucurbita perennis* (Cockerell) are given as wild food-plants of *H. folicacea*, but these records are probably also referable to *H. punctpennis*.

Epitrix cucumeris. It is certainly strange that we do not yet know the food-plant of the larva of this common species which is so often referred to in economic literature, and which in the imago state is almost omnivorous. Its true food-plant will no doubt prove to be one of the Solanaceæ, and the larva is probably a root-feeder. *E. fuscula* is in the more southern States just as common as *cucumeris* and has no doubt occasionally been confounded therewith in the records.

Phyllotreta albionica. The species mentioned under this name as injuring cabbages in Colorado (C. V. Riley, Ann. Rep. Comm. Agric., 1884, p. 308) is in all probability *Ph. pusilla* which is much more abundant in that State than *albionica*. Before the publication of Dr. Horn's Synopsis these two species were not separated in our collections.

Prof. Riley remarked, in discussing this paper, that little difficulty would be experienced in referring any species of particularly economic importance to food-plant by comparison with material in the National Collection. He was glad that Mr. Schwarz had gone over the records in the light of Horn's latest revision, but asked whether it was certain that Dr. Horn is right in all the reference of species.

Mr. Schwarz stated that Dr. Horn's work was of such an excellent character that his determinations should be adhered to. He stated also that the important species had often been incorrectly referred, and that even in the case of such species some of the records were open to doubt. The National Collection would serve to verify Prof. Riley's own writings, but not those of others.

MAY 7, 1891.

President Marx in the chair. Thirteen members and two visitors present.

Mr. C. H. Roberts, of New York, was elected a corresponding member, and Messrs. F. H. Chittenden and A. B. Cordley active members of the Society.

Mr. Howard exhibited specimens of a species of Bombus which had been attracted in great numbers to the blossoms of a large horse-chestnut near his house from April 27th to date. He had watched them with some interest on account of their crazy actions, which were of such a character that he at first suspected a toxic effect in the nectar of the blossoms. Many of them passed the night in a drunken position on the ground near the tree while others entered his house, and he had found as many as six on a single window-sill on opening the shutters of a morning. They readily revived and flew away. He had noticed the toxic effect of Fox-glove and Wistaria on *Bombus*, but was not sure whether the curious actions of these individuals could be ascribed to this source or to some other. He desired the opinion of the members.

Prof. Riley suggested that the cool weather then prevailing might have something to do with their peculiar actions, and stated that he had observed Lachnosternas exhibiting torpor and languor in the same way. He identified the species exhibited by Mr. Howard as *Bombus virginicus*.

In reply, Mr. Howard stated that their peculiar actions were not confined to the cool period, but were equally marked in warm weather.

Mr. Marlatt referred to the similar actions of bees that had fed on the juices of partially fermented and decayed mulberries, which had resulted in actually making the insect drunk, and was of the opinion that some toxic principle in the nectar of the horse-chestnut was the cause of the peculiar actions of the bees in the present instance.

Mr. Ashmead had observed similar effects resulting from the feeding of robins on chinaberries, the birds becoming thoroughly inebriated.

Mr. Mann said that he had seen the statement that the horse-chestnut is intoxicating to bees.

Mr. Schwarz remarked that the bumble-bees found thus early in the season are necessarily all hibernated females, and it would not seem to be impossible that among them there are specimens that had not been impregnated in the fall. Such specimens cannot possibly found a new colony in the spring, and would naturally act differently from the impregnated females.

Mr. Schwarz exhibited and briefly remarked upon the following Coleoptera: *Charistena lecontei*, found at Fortress Monroe, Va.; *Bagous sellatus*, found at the same place; *Sphærius politus*, found in Michigan and Alabama, and *Lutrochus luteus* from Michigan.

Dr. Marx presented the following paper:

A CONTRIBUTION TO THE STUDY OF THE SPIDER FAUNA OF THE ARCTIC REGIONS.

By Geo. Marx.

The demands of some groups of Arachnida upon nature for their existence appear to be very simple, and seem to have no regard to climatic, geologic or other physical influences, but to depend solely on one condition, namely, the presence of suitable food, for amongst the Arthropod fauna in the arctic region, where ten months of the year is winter with a temperature often falling to 100 degrees below freezing point, we find three orders of Arachnida—the Aranæ, Opiliones and Acari—well represented by many genera and species, and by such genera and species as exist and prosper at the same time under entirely different conditions, as in the regions of the Sonoran and even subtropical zones.

These three orders seem especially adapted to a life in the polar zone, for they not only exist in quite a number of species, but also in a great number of specimens of each species. General—then Lieutenant—Greely, commanding the late Lady Franklin Bay expedition, states that he met in the summer months at Ft. Conger (81° 44 north latitude) with a rich insect fauna: "Spiders, mosquitoes, flies, caterpillars, moths, and opiliones were frequently found in the immediate neighborhood of our camp."

My friend H. Biederbeck, the hospital steward of that expedition, informed me that they had prepared at Ft. Conger a large collection of entomological specimens, amongst which which were a great number of Arachnida. This valuable col-

lection, with so much other precious scientific material, had unfortunately to be left behind on the retreat of this ill-fated party.

The Arachnida of the polar region have attracted the attention of the earlier European scientific explorers, for we find as early as 1772 species of spiders recorded from Iceland and a few years later from Greenland. We possess at the present time the description of 175 species of arctic and sub-arctic Araneæ from the Eastern Hemisphere.

The Arachnida of the American arctic continent and its islands are comparatively little known, as only three species from the polar and ten from the sub-arctic or the extreme nothern boreal zone* had been described before Count Keyserling published twenty-three species of the families Theridiidæ, Dictynidæ and Thomisdæ from the arctic regions of North America, which material I had sent him from my collection. My collection contains, besides these twenty-three species, eighty-five additional ones, the descriptions and illustrations of which I hope to be able soon to lay before this Society.

I gladly avail myself here of the opportunity to acknowledge my most sincere thanks to the following gentlemen, through whose kindness I came into possession of such a large and valuable collection from the distant polar regions of our Western Hemisphere: Mr. Lucien Turner, who presented me with his rich spider collection, which he had prepared during the four years of his stay at Ft. Simo, Ungava Bay, North Eastern Labrador (near 58° N. L.); the same gentleman presented me also with some species from Unalaska; Dr. T. H. Bean, from whom I obtained several species from Wrangle, St. George and Schumagin Islands and Plover Bay; Dr. Stejenegar, to whose generous kindness I owe a number of species from Commander Island on the coast of Kamschatka; Dr. Ulysses Browne, of Scotland, who presented me with a great part of his collection of Arachnids, not only from Alaska and the Aleutian Islands, but also from the coast of Washington, Oregon, California and Central America; Mr. Murdoch, through whom I obtained a specimen from Point Barrow.

Prof. Simon has published in Bull. d. l. Soc. Zool. d. France, 1887, a list of the principal works on the Arachnida of the arctic region, which I quote in the following. The localities from which the spiders have been observed are as follows:

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* The ten species which Prof. Thorell described were collected by Prof. Packard in the southern part of Labrador, a region considerably south of the arctic belt. Many of the spiders which Dr. Koch described from Siberia come from a region not precisely arctic, but belonging rather more to the boreal zone.

Greenland, Iceland, Lapland, Finland, Spitzbergen, Siberia and Nova Zembla.

1. OLAFSEN, E.—Eggert Olafsen och Biarne Povelsens Resa igiennem Island. 1772.
2. MÜLLER, O. F.—Zoologiæ danicæ prodromus. 1776.
3. FABRICIUS, O.—Fauna grœnlandica, etc. 1780.
4. NORDMANN, A. v.—Erstes Verzeichniss der in Finnland und Lappland gef. Spinnen. 1862.
5. THORELL, T.—Om Arachnider fran Spitzbergen och Beeren Eiland. Kongl. Vet. Akad. Handl. XXVIII. 1871.
6. ID—Om nagra Arachnider fran Grœnland, Ibid. XXIX. 1872.
7. CAMBRIDGE, O. P.—On some new and little-known spiders from the arctic region. Ann. & Mag. Nat. Hist. 1877.
8. KOCH, L.—Die zweite deutsche Nordpolfahrt in den Jahren, 1869-70. Wissensch. 1 Abtheil., pp. 400–403.
9. THORELL, T.—Notice of the Spiders of the Polaris Expedition, Greenland. 1878.
10. KOCH, L.—Arachniden aus Siberia und Novaja Semlja, ges. d. schwd Expedition. Kongl. Vet. Akad. Handl. 1879.
11. VAN HASSELT—Spinnen dor Dr. Tenkate noordl. Lappland verz. Tydschr. voor. Entom. Vol. 27. 1884.
12. SIMON, E.—Liste des Arachn. recueill. en Laponie, Bull. Soc. Zool. d. France. 1887.
13. ID—Arachn. de Grœnland. Ibid. X. 1889.

Besides these thirteen works, which treat exclusively upon arctic spiders, the following five publications contain also descriptions of many polar Araneæ:

14. SUNDEVALL—Svenska Spindlarnes Beskrifning—Kongl. Vet. Akad. Handl. 1829.
15. WESTRING—Araneæ suecicæ descriptæ. 1861.
16. KOCH, L.—Die Arachniden-familie der Drassiden. 1866-67.
17. THORELL, T.—Remarks on synonyms of European Spiders. 1871.
18. ID.—Descriptions of several European and North African Spiders. Kongl. Vet. Akad. Handl. XIII. No. 5. 1875.

All these authors have had under consideration the Arctic Spiders of the Eastern Hemisphere.

The spiders of the American polar region have been collected from the following places: Melville Island, Cornwallis Island, Labrador, Alaska, the Aleutian, some Islands in the Behring Sea, and the Commander Island on the coast of Siberia.

The list of the authors is as follows:

19. KIRBY—Capt. Parry's voyage for the discovery of a Northwest passage, 1819-20. London, 1824. Appendix X.
20. WHITE, A.—Sutherland's Jour. of a voyage in Baffin's Bay and Barrow Straits, 1850, Vol. II.

21. THORELL—Notice of some Spiders from Labrador. Proceed. Boston Nat. Hist., 1875.
22. KEYSERLING—Neue Spinnen a. Amerika, V, Verhandl. zool. bot. Gesellsch. Wien, 1883.
23. IBID.—Die Spinnen Amerikas, II., Theridiidæ.
24. ID.—Neue Spinnen a. Amerika, Verhandl., VII, zool. bot. Gesellsch. Wien, 1887.
25. MARX—Description of some Arctic Spiders from the Western Hemisphere (in preparation).

In the following list are enumerated all of the species which have so far been found and described from the Arctic regions of the globe. I have included the new and undescribed species of my collection. As a large part of the literature was inaccessible to me, it was impossible to compare the different descriptions, and there may be some species enumerated which are synonyms.

The species which belong to the Western Hemisphere are marked with an asterisk; the numbers after the author's name indicate the numbers of the bibliographical list.

TUBITELARIÆ.

Fam. DRASSIDÆ.

	Gnaphosa borealis, Thor.	Lapland, Thorell, 18.
	bilineata, L. K.	Siberia, 68°, 25, 10.
	lapponum, L. K.	Lapland, L. Koch, 16.
	" L. K.	Finland, Simon, 12.
	muscorum, L. K.	Lapland, L. Koch, 16.
	" L. K.	Siberia, 69°, 15, L. Koch, 10.
	montana, L. K.	Siberia, L. Koch, 10.
*	*brumalis*, Thor.	Labrador, Thorell, 21.
*	" Thor.	Ungava Bay, Labrador, Marx, 25.
*	" Thor.	Allognagik Lake, Alaska, Marx, 25.
*	*tricuspida*, Marx.	Ungava Bay, Labrador, Marx, 25.
*	" Marx.	Sitka, Marx, 25.
*	*turnerii*, Marx.	Labrador, Marx, 25.
*	*polaris*, Marx.	Unalaska, Marx, 25.
*	*conspersa*, Thor.	Fort Yukon, Alaska, Marx, 25.
*	" Thor.	Labrador, Marx, 25.
*	*frigidaria*, Marx.	Labrador, Marx, 25.
*	*tristis*, Marx.	Labrador, Marx, 25.
	Prosthesima pedicerii, Scop.	Siberia, L. Koch, 10.
	siberiana, Marx.	Commander Island, Marx, 25.
	tristis, Marx.	Sitka, Marx, 25.
	Drassus infuscatus, Westr.	Lapland, Nordmann, 4.
	cognatus, Westr.	Nova Zembla, L. Koch, 10.
	stuxbergii, L. K.	Siberia, L. Koch, 10.
*	*Micaria labradoriensis*, Marx.	Labrador, Marx, 25.
*	*Pythonissa pallida*, Marx.	Sitka, Marx, 25.

Fam. Dictynidæ.

Dictyna hamifera, Thor.	Greenland, Thorell, 6.
borealis, Cambr.	Greenland, Cambridge, 7.
* †*keyserlingii*, Marx.	Sitka, Marx, 25.
* *polaris*, Marx.	Commander Island, Marx, 25.
Titanœca siberica, L. K.	Siberia, L. Koch, 10.

Fam. Clubionidæ.

Clubiona erratica, C. K.	Siberia, 62°, L. Koch, 10.
germanica, Thor.	Siberia, 63°, 30, L. Koch, 10.
* *frigidula*, Thor.	Labrador, Thorell, 21.
* *ungavensis*, Marx.	Labrador, Marx, 25.
* *labradoriensis*, Marx.	Labrador, Marx, 25.
* *arctica*, Marx.	Allognagik, Alaska, Marx, 25.
* *alascensis*, Marx.	Cape Smith, Marx, 25.
Agrœca brunnea, Thor.	Siberia, L. Koch, 10.
chrysea, Thor.	Siberia, L. Koch, 10.
maculata, Thor.	Siberia, L. Koch, 10.
**Phrurolithus polaris*, Marx.	Unalaska, Marx, 25.
**Hina notata*, Marx.	Labrador, Marx, 25.
**Liccranum boreale*, Marx,	Commander Island, Siberia, Marx, 25

Fam. Agalenidæ.

Argyroneta aquatica, Clk.	Lapland, Nordmann, 4.
" Clk.	Siberia, 62°, 50, L. Koch, 10.
Cryphœca silvicola, C. K.	Lapland, Nordmann, 4.
" C. K.	Siberia, 63°, 50, L. Koch, 10.
Tegenaria detestabilis, Cambr.	Greenland, Cambridge, 7.
* *derhami*, Scop.	Labrador, Marx, 25.
**Cybœus algidus*, Marx.	Sitka, Marx, 25.
* *borealis*, Marx.	Labrador, Marx, 25.
**Cœlotes labradoriensis*, Marx.	Labrador, Marx, 25.
**Cicurina arcuata*, Ksling.	Labrador, Marx, 25.
**Agalena hentzii?* Becker.	Labrador, Marx, 25.

RETITELARIÆ.

Fam. Theridiidæ.

Theridium varians, Hahn.	Siberia, 60°, 50, L. Koch, 10.
umbraticum, Hahn.	Siberia, 66°, 25, L. Koch, 10.
serratosignum, Hahn.	Siberia, 66°, 25, L. Koch, 10.
bellissimum, L. K.	Siberia, 66°, 25, L. Koch, 10.
oleatum, L. K.	Nova Zembla, L. Koch, 10.
pictum, Walck.	Lapland, Nordmann, 4.

† Keyserling described this species as *borealis*, a name which Cambridge had already used.

eridium sisyphum, Clk.	Lapland, Nordmann, 4.
" Clk.	Greenland, Fabricius, 3.
marxii, Ksling,	Unalaska, Keyserling, 23.
" Ksling.	Yes Bay, Alaska, Marx, 25.
" Ksling.	Allognagik Lake, Marx, 25.
nyphia emertonii, Thor.	Labrador, Thorell, 21.
turbatrix, Cambr.	Greenland, Cambridge, 7.
montana, Clk.	Lapland, Nordmann, 4.
" Clk.	Siberia, 61°, L. K., 10.
sobria, Thor.	Spitzbergen, Thorell, 5.
" Thor.	Lapland, Simon, 12.
" Thor.	Greenland, Cambridge, 7.
approximata, Camb.	Siberia, 61°, L. Koch, 10.
clathrata, Sunder.	Siberia, 61°, L. Koch, 10.
alticeps, Sunder.	Siberia, 60°, 10, L. Koch, 10.
insignis, Blackw.	Siberia, 62°, 50, L. Koch, 10.
scopigera, Grube.	Siberia, 64°, 40, L. Koch, 10.
nebulosa, Sunder.	Siberia, 64°, 40, L. Koch, 10.
index, Thor.	Siberia, 65°, 50, L. Koch, 10.
conspersa, L. K.	Siberia, 63°, 50, L. Koch, 10.
cultrigera, L. K.	Siberia, 68°, 50, L. Koch, 10.
mordax, L. K.	Siberia, 69°, 15, L. Koch, 10.
albula, L. K.	Siberia, 63°, 50, L. Koch, 10.
investa, L. K.	Siberia, 68°, 50, L. Koch, 10.
trucidans, L. K.	Siberia, 62°, 50, L. Koch, 10.
latebricola, L. K.	Nova Zembla, 72°, 40, L. Koch, 10.
luteipes, L. K.	Siberia, 63°, 30, L. Koch, 10.
picturata, L. K.	Siberia, 69°, 15, L. Koch, 10.
proletaria, L. K.	Siberia, 71°, L. Koch, 10.
vidua, L. K.	Siberia, 68°, L. Koch, 10.
humilis, L. K.	Siberia, 70°, L. Koch, 10.
polita, L. K.	Siberia, 65°, L. Koch, 10.
semiatra, L. K.	Siberia, 65°, L. Koch, 10.
luminis, L. K.	Siberia, 62°, 50, L. Koch. 10.
similior, L. K.	Siberia, 63°, 30, L. Koch, 10.
simillima, L. K.	Siberia, 63°, 17, L. Koch, 10.
terrena, L. K.	Siberia, 63°, 17, L. Koch, 10.
ingloria, L. K.	Siberia, 63°, 50, L. Koch, 10.
decipiens, L. K.	Siberia, 64°, 25, L. Koch, 10.
nigriventris, L. K.	Siberia, 70°, 39, L. Koch, 10.
hebescens, L. K.	Siberia, 71°, 20, L. Koch, 10.
clara, L. K.	Siberia, 62°, 50, L. Koch, 10.
concinna, L. K.	Siberia, 60°, 10, L. Koch, 10.
desolata, L. K.	Siberia, 60°, 50, L. Koch, 10.
sitkaensis, Keys.	Alaska, Keyserling, 23.
arctica, Keys.	Alaska, Keyserling, 23.
ungavensis, Marx.	Labrador, Marx, 25.

**Linyphia nivalis*, Marx.	Unalaska, Marx, 25.
* *adspersa*, Marx.	Cape Smith, Marx, 25.
**Satilatlas marxii*, Keys.	Aleutian Island, Keyserling, 23.
Pedanosthetus lividus, Blackw.	Siberia, 60°, 50, L. Koch, 10.
* " Blackw.	Alaska, Keyserling, 23.
* " Blackw.	Finland, Simon, 12.
Steatoda bipunctata, Linn.	Iceland, Muller, 2.
" Linn.	Greenland, Fabricius, 3.
" Linn.	Iceland, Olaffsen, 1.
" Linn.	Lapland, Nordmann, 4.
" Linn.	Finland, Simon, 12.
Lithyphantes corrolatus, Linn.	Siberia, 60°, 50, L. Koch, 10.
* *marmoratus*, Hentz.	Ungava Bay, Labrador, Marx, 25.
sobrius, Thor.	Lapland, Simon, 12.
* *alascensis*, Marx.	Sitka, Marx, 25.
Erigone dentipalpis, Wid.	Siberia, 60°, 50, L. Koch, 10.
tirolensis, L. K.	Nova Zembla, L. Koch, 10.
" L. K.	Siberia, 72°, 15, L. Koch, 10.
arctica, White.	Siberia, 72°, 15, L. Koch, 10.
" White.	Nova Zembla, L. Koch, 10.
" White.	Greenland, Cambridge, 7.
* " White.	Cornwallis Island, Baffin's Bay, White, 20.
retusa, Westr.	Siberia, 70°, 39, L. Koch, 10.
" Westr.	Nova Zembla, L. Koch, 10.
atra, Blackw.	Nova Zembla, L. Koch, 10.
" Blackw.	Siberia, L. Koch, 10.
" Blackw.	Lapland, Van Hasselt, 11.
remota, L. Koch.	Siberia, 72°, 15, L. Koch, 10.
rurestris, L. Koch.	Nova Zembla, L. Koch, 10.
borea, L. Koch.	Nova Zembla, L. Koch, 10.
aquilonaris, L. Koch.	Nova Zembla, L. Koch. 10.
" L. Koch.	Siberia, 70°, 50, L. Koch, 10.
granulosa, L. Koch.	Siberia, 69°, 15, L. Koch, 10.
vexatrix, Cambr.	Greenland, Cambridge, 7.
" Cambr.	Nova Zembla, L. Koch, 10.
" Cambr.	Siberia, L. Koch, 10.
psychrophila, Thor.	Spitzbergen, Thorell, 5.
" Thor.	Greenland (Polaris), Thorell, 9.
" Thor.	Greenland, Cambridge, 7.
" Thor.	Lapland, Simon, 12.
" Thor.	Nova Zembla, L. Koch, 10.
" Thor.	Siberia, L. Koch, 10.
mirabilis, L. K.	Siberia, 68°, 45, L. Koch, 10.
taczanowskia, L. K.	Siberia, 68°, 45, L. Koch, 10.
incerta, L. K.	Siberia, 72°, 13, L. Koch, 10.
mendica, L. K.	Siberia, 71°, 40, L. Koch, 10.

igone mendica L. K.	Nova Zembla, L. Koch, 10.
oxycephala, L. K.	Nova Zembla, L. Koch, 10.
" L. K.	Siberia, 72°, 15, L. Koch, 10.
succinea, L. K.	Siberia, 60°, 50, L. Koch, 10.
calicinosa, L. K.	Siberia, 60°, 50, L. Koch, 10.
vulnerata, L. K.	Siberia, 60°, 10, L. Koch, 10.
semiflava, L. K.	Siberia, 68°, 45, L. Koch, 10.
barbata, L. K.	Siberia, 68°, 45, L. Koch, 10.
" L. K.	Nova Zembla, L. Koch, 10.
pelifrons, L. K.	Siberia, L. Koch, 10.
leviceps, L. K.	Siberia, L. Koch, 10.
barbigera, L. K.	Nova Zembla, L. Koch, 10.
incondita, L. K.	Siberia, L. Koch, 10.
formosa, L. K.	Siberia, L. Koch, 10.
submissa, L. K.	Siberia, L. Koch, 10.
æsopea, L. K.	Siberia, L. Koch, 10.
proterva, L. K.	Siberia, L. Koch, 10.
hyperborea, L. K.	Siberia, L. Koch, 10.
faceta, L. K.	Siberia, L. Koch, 10.
brachyopsis, L. K.	Nova Zembla, L. Koch, 10.
deserta, L. K.	Siberia, L. Koch, 10.
imula, L. K.	Siberia, L. Koch, 10.
mollicata, L. K.	Siberia, L. Koch, 10.
diversa, L. K.	Siberia, L. Koch, 10.
repudiata, L. K.	Siberia, L. Koch, 10.
longipalpis, Sund.	Lapland, E. Simon, 12.
" Sund.	Finland, Van Hasselt, 11.
" Sund.	Lapland, Nordmann, 4.
" Sund.	Spitzbergen, Thorell, 5.
dentipalpis, Sund.	Lapland, Nordmann, 4.
affinis, Blackw.	Lapland, Simon, 12.
rufus, Wid.	Lapland, Van Hasselt, 11.
rufipes, Linn.	Greenland, Fabricius, 3.
helmgreenii, Thor.	Spitzbergen, Thorell, 5.
spitzbergenensis, Thor.	Spitzbergen, Thorell, 5.
" Thor.	Greenland, Thorell, 6.
glacialis, Thor.	Greenland, Thorell, 6.
frigida, Thor.	Greenland, Thorell, 6.
vaginata, Thor.	Greenland, Thorell, 6.
macrochaera, Thor.	Lapland, Thorell, 18.
herniosa, Thor.	Lapland, Thorell, 18.
whymperii, Cambr.	Greenland, Cambridge, 7.
provocans, Cambr.	Greenland, Cambridge, 7.
venatrix, Cambr.	Greenland, Cambridge, 7.
penessa, Thor.	Greenland, Polaris, Thorell, 9.
polaris, Keysl.	Alaska, Keyserling, 23.
vacerosa, Keysl.	Unalaska, Keyserling, 23.

**Erigone simillima*, Keysl.	Unalaska, Keyserling, 23.
* *schumaginensis*, Keysl.	Aleutian Island, Keyserling, 23.
* *siberiana*, Keysl.	Commander Island, Siberia, Keyserling, 23.
* *famelica*, Keysl.	Sitka, Alaska, Keyserling, 23.
* *umbraticola*, Keysl.	Sitka, Alaska, Aleutian, Keyserling, 23.
* *præpulchra*, Keysl.	Unalaska, Keyserling, 23.
* *ululabilis*, Keysl.	Alaska, Keyserling, 23.
* *usurpabilis*, Keysl.	Aleutian Islands, Keyserling, 23.
* *urusta*, Keysl.	Aleutian Island, Keyserling, 23.
* *famularis*, Keysl.	Alaska, Keyserling, 23.
* *falsifica*, Keysl.	Kanaka, Aleutian Island, Keyserling, 23.
* *formica*, Emert.	Unalaska, Keyserling, 23.
* *viaria*, Blackw.	Allognagik, Keyserling, 23.
* *turnerii*, Marx.	Labrador, Marx, 25.
* *frigidula*, Marx.	Commander Isl., Siberia, Marx, 25.
* *viaria*, Blackw.	Labrador, Marx, 25.
* *tristis*, Marx.	Wrangel Island, Marx, 25.
* *murdochii*, Marx.	Point Barrow, Marx, 25.
* *alascensis*, Marx.	Fort Yukon, Marx, 25.
* *mystacea*, Marx.	Commander Island, Marx, 25.
* *septentrionalis*, Marx.	Allognagik, Marx, 25.
* *nivicola*, Marx.	Unalaska, Marx, 25
* *beanii*, Marx.	Port Althrop, St. George Island Marx, 25.
* *algens*, Marx.	Commander Island, Marx, 25.

ORBITELARIÆ.

Fam. EPEIRIDÆ.

Epeira silvicultrix, C. K.	Siberia, 60°, 50, L. Koch, 10.
marmorea, Clk.	Siberia, 66°, 45, L. Koch, 10.
" Clk.	Lapland, Nordmann, 4.
cornuta, Clk.	Siberia, 66°, 25, L. Koch, 10.
* *patagiata*, Clk.	Labrador, Thorell, 21.
" Clk.	Lapland, Simon, 12.
* " Clk.	Sitka, Cape Smith, Ft. Yukon, Marx, 25
* " Clk.	Labrador, Marx, 25.
diademata, Clk.	Iceland, Olaffsen, 1.
quatrata, Clk.	Lapland, Simon, 12.
cucurbitana, Clk.	Lapland, Simon, 12.
umbratica, Clk.	Lapland, Simon, 12.
* *carbonaria*, L. Koch.	Labrador, Thorell, 21.
* †*strix*, Hz.	Labrador, Marx, 25.

† Since I have carefully compared the form of the epigynum of *Epeira strix* Hz., with that of the European *cornuta*, Bl., I am convinced that both are distinc and separate species.

eira silvatica, Emert.	Ft. Yukon, Marx, 25.
incestifica, Keysl.	Sitka, Marx, 25.
borealis, Marx.	Unalaska, Marx, 25.

Fam. TETRAGNATHIDÆ.

tragnatha extensa, Linn.	Lapland, Simon, 12.
" Linn.	Aleutian, Commander Isl., Siberia, Marx, 25.
" Linn.	Labrador, Marx, 25.
" Linn.	Lapland, Nordmann, 4.
elongata, Walck.	Sitka, Ounalaska, Marx, 25.
greenlandii, Thor.	Greenland, Thorell, 6.
borealis, L. K.	Siberia, 63°, 50, L. Koch, 10.
chygnatha clerkii, Sund.	Siberia, 60°, 10, L. Koch, 10.
listerii, Sund.	Siberia, 60°, 50, L. Koch, 10.
tristriata, C. K.	Sitka, Marx, 25.

LATERIGRADÆ.

Fam. THOMISIDÆ.

sticus borealis, Keysl.	Fort Yukon, Alaska, Keyserling, 22.
austerus, C. K.	Siberia, 60°, 50, L. Koch, 10.
bifasciatus, C. K.	Lapland, Nordmann, 4.
cristatus, Clk.	Lapland, Nordmann, 4.
luctuosus, Blackw.	Lapland, Simon, 12.
labradoriensis, Keysl.	Labrador, Marx, 25.
stomachosus, Keysl.	Labrador, Marx, 25.
triguttatus, Keysl.	Labrador, Marx, 25.
polaris, Marx.	Sitka, Marx, 25.
yptila horticola, C. K.	Lapland, Simon, 12.
septendrionalis, L. K.	Siberia, 60°, 55, L. Koch, 10.
ilodromus decorus, Westr.	Siberia, 66°, 25, L. Koch, 10.
blandus, L. K.	Siberia, 68°, 55, L. Koch, 10.
aureolus, Clk.	Lapland, Nordmann, 4.
alascensis, Keysl.	Sitka, Alaska, Keyserling, 22.
rufus, Walck.	Ft. Yukon, Marx, 25.
turnerii, Marx.	Labrador, Marx, 25.
nebulosus, Marx.	Commander Isl., Siberia, Marx, 25.
bellus arcticus, Thor.	Greenland, Thorell, 6.
formicinus, Clk.	Lapland, Nordmann, 4.
" Clk.	Greenland, Cambridge, 7.
oblongus, Walck.	Lapland, Simon, 12.
" Walck.	Unalaska, Commander Isl., Marx, 25.
anatus rubicundus, Keysl.	Labrador, Marx, 25.
arcticus, Thor.	Greenland, Thorell, 6.
formicinus, Clk.	Lapland, Nordmann, 4.

CITIGRADÆ.

Fam. Lycosidæ.

	Dolomedes fimbriatus, Clk.	Lapland, Simon, 12.
	" Clk.	Siberia, L. Koch, 10.
	Lycosa sylvicola, Sund.	Lapland, Nordmann, 4.
	ruricola, De Geer.	Lapland, Simon, 12.
	tæniata, C. K.	Lapland, Nordmann, 4.
	pulverulenta, Clk.	Lapland, Nordmann, 4.
	" Clk.	Lapland, Simon, 12.
	insignata, Thor.	Greenland, Thorell, 6.
	" Thor.	Lapland, Simon, 12.
	exasperans, Cambr.	Greenland, Cambridge, 7.
	imanis, L. K.	Siberia, L. Koch, 10.
*	*furcifera*, Thor.	Labrador, Thorell, 21.
*	*fuscula*, Thor.	Labrador, Thorell, 21.
*	*grœnlandrica*, Thor.	Labrador, Thorell, 21.
*	*turnerii*, Marx.	Ungava Bay, Labrador, Marx, 25.
*	*polaris*, Marx.	Allognagik Lake, Marx, 25.
*	" Marx.	Sitka, Marx, 25.
*	" arx.	Fort Yukon, Marx, 25.
*	*longipatella*, Marx.	Allognagik Lake, Marx, 25.
*	*alascensis*, Marx.	Fort Yukon, Marx, 25.
*	*beanii*, Marx.	Plover Bay, Mark, 25.
*	*septentrionalis*, Marx.	St. George Island, Marx, 25.
*	" Marx.	Unalaska, Marx, 25.
*	" Marx..	Schumagin Island, 25.
*	*stejnegerii*, Marx.	Commander Island, Marx, 25.
*	*nivicola*, Marx.	Sitka, Marx, 25.
*	" Marx.	Yukon River, Marx, 25.
	Pardosa, *monticola*, Clk.	Lapland, Nordmann, 4.
	" Clk.	Lapland, Van Hasselt, 11.
	agricola, Thor.	Lapland, Van Hasselt, 11.
	lignaria, Clk.	Lapland, Van Hasselt, 11.
	" Clk.	Lapland, Simon, 12.
	amentata, Clk.	Lapland, Simon, 12.
	" Clk.	Greenland, Muller, 2.
	" Clk.	Greenland, Fabricius, 3.
	" Clk.	Lapland, Van Hasselt, 11.
	" Clk.	Iceland, Olaffsen, 1.
	ligubris, Walck.	Finland, Simon, 12.
	pernix, Thor.	Finland, Simon, 12.
	atrata, Thor.	Finland, Simon, 12.
	guerneii, Simon.	Norway, Simon, 12.
	raboti, Simon.	Finland, Simon, 12.
	hyperborea, Thor.	Finland, Simon, 12.
	paludicola, Clk.	Lapland, Nordmann, 4.

rdosa, grœnlandica, Thor.	Greenland, Thorell, 6.
" Thor.	Greenland, Cambridge, 7.
glacialis, Thor.	Greenland, Thorell, 6.
" Thor.	Greenland, Cambridge, 7.
" Thor.	Greenland, Thorell (Polaris), 9.
eisenii, Thor.	Lapland, Thorell, 18.
œquinolarus, L. K.	Greenland, L. Koch, 8.
" L. K.	Greenland, Simon, 13.
giebellii, Pov.	Siberia, L. Koch, 10.
pallustris, Linn.	Nova Zembla, L. Koch, 10.
" Linn.	Siberia, L. Koch, 10.
lasciva, L. K.	Siberia, 68°, 30, L. Koch, 10.
indecora, L. K.	Siberia, 69°, 15, L. Koch, 10.
alalanta, L. K.	Siberia, 65°, 55, L. Koch, 10.
melvillensis, Kirby.	Melville Isl., Kirby, 19.
insularis, Marx.	Labrador, Marx, 25.
albopatella, Em.	Labrador, Marx, 25.
montana, Em.	Labrador, Marx, 25.
luteola, Marx.	Unalaska, Marx, 25.
" Marx.	Kanaka Isl., Marx, 25.
" Marx.	Sitka, Marx, 25.
pilosa, Marx.	Sitka, Marx, 25.
" Marx.	Yukon, Marx, 25.
" Marx.	Unalaska, Marx, 25.
" Marx.	Commander Isl., Marx, 25.
" Marx.	Labrador, Marx, 25.
" Marx.	Allognagik, Marx, 25.
capitata, Marx.	Commander Isl., Marx, 25.
" Marx.	Labrador, Marx, 25.
" Marx.	Allognagik, Marx, 25.
" Marx.	Ft. Yukon, Marx, 25.
nœvia, Marx.	Labrador, Marx, 25.
ferox, Marx.	Labrador, Marx, 25.
nivalis, Marx.	Point Barrow, Marx, 25.
borealis, Marx.	Allognagik, Marx, 25.
" Marx.	Ft. Yukon, Marx, 25.
ungavensis, Marx.	Labrador, Marx, 25.
simmo, Marx.	Labrador, Marx, 25.
turnerii, Marx.	Labrador, Marx, 25.
undata, Marx.	Unalaska, Marx 25.
" Marx.	Sitka, Marx, 25.
pellita, Marx.	Sitka, Marx, 25.
" Marx.	Allognagik, Marx, 25.
" Marx.	Ft. Yukon, Marx, 25.
" Marx.	St. George Isl., Marx, 25.
" Marx.	Unalaska, Marx, 25.
" Marx.	Schamagin Isl., Marx, 25.
rata piratica, Clk.	Nova Zembla, L. Koch, 10.

SALTIGRADÆ.

Fam. ATTIDÆ.

Heliophanes auratus, C. K.	Siberia, L. Koch, 10.
Attus rubicola, C. K.	Siberia, 61°, 50, L. Koch, 10.
tereoratus, Clk.	Lapland, Nordmann, 4.
" Clk.	Greenland, Muller, 2.
Hasarius falcatus, Clk.	Norway, Simon, 12.
Epiblemum scenicum, Clk.	Lapland, Nordmann, 4.
" Clk.	Greenland, Muller, 2.
**Epiblemum scenicum*, Clk.	Labrador, Marx, 25.
**Phiddipus morsitans*, Walck.	Labrador, Marx, 25.

The results of a close study of the polar spider fauna of both hemispheres can be summarized as follows:

1. The arctic spider fauna is composed of the ten families which we may term the common ones, their species constituting the main bulk of the entire spider fauna of the world. They are cosmopolitans, and are found almost wherever animal life is possible.

2. The genera of the arctic spider fauna are, without exception, those which also occur in other regions of the world, and there has been found so far not one genus which is original to that zone of eternal ice and snow. This is a very remarkable fact, since in all other Arthropod orders and those of higher rank the polar fauna is distinguished by special and peculiar forms.

3. Even among the species a vast number occur which live in milder climates and under entirely different conditions and influences, and we find some families represented by only such forms, lacking entirely original arctic species.

4. The differences between the faunas of the Eastern and Western Hemispheres are slight, and generally speaking, those forms which are the most frequently represented in the one are also found in the larger proportion in the other.

Another question, however, arises in connection with the study of the arctic life of spiders, namely: What are the influences which enable these species to endure and overcome such severe conditions as an arctic winter of ten months' duration with a temperature at which all organic life under other circumstances would perish? The answer would be, the ability to accommodate their habits to those circumstances.

Although we know very little of the life habits of the Spiders in the polar region, we can infer from the few points known to us that such is the fact.

Prof. Nordenskiold informs us, that the arctic spiders live in colonies under stones or other protected places. This fact has however also been observed in the high Alpine regions near

the snow border. In a region where the highest plants do not reach over six inches, as at Ft. Conger, (Lady Franklin Bay Expedition), Hospital Steward Biederbeck observed large-sized spiders which looked like the *Kreuzspinne* (*Epeira diademata*) of Germany having made webs between the Saxifragas from four to six inches high. (This was probably *E. patagiata*.) Now these orbweavers never constructed their webs so close to the ground under ordinary circumstances.

These two points prove therefore, from actual observation, that the spiders are capable of accommodating their habits to the surrounding conditions.

The curriculum of plant and lower animal life is limited in these northern regions to the few weeks of arctic summer, and what takes generally weeks to develop under other conditions is here accomplished in days, for the time is short — a whole life has to be lived through in this short space of time and nature is now in busy haste.

The polar spider leaves its egg-shell at the first sign of the thawing, and crawls out of its cocoon at the first warm ray of the sun. Its development is so rapid that the collector rarely catches an immature form. It finds ample food in the swarming Diptera, Neuroptera or Lepidoptera and it has attended to all its material duties before the parting sun-rays have ceased to spend their warmth upon the freezing earth.

These duties consist principally in preparing the eggs for the perilous stage of hibernation. If we look upon the ways in which the spider under more favorable conditions preserves its eggs, we find two principal methods: First—the cluster of eggs, generally many in number, the inner ones protected by those on the outside, and always surrounded by a bundle of silken threads, the product of the spinning organs; this cocoon is covered by a strong, paper-like, and waterproof sheath and then fastened in a recess on the underside of a stone which is half sunk into the ground, as in the Drassidæ. Thus the dormant life of the embryo is protected from the perils of external influences, for buried under the ground it is secure from rain and frost by means of a non-conductive fabric of sufficient thickness, for we may well presume that these layers are in those regions made much thicker than with the same species in a warmer climate.

The other method by which the spider hibernates is the following: Many forms spin around the egg-mass a quantity of loose threads without the waterproof paper-like covering, but these are none the less securely protected by the fact that they are spun on the leaf of a plant, and the leaf is wrapped around the cocoon and its edges securely fastened by glue or threads so as to make the whole also waterproof. Although

in the warmer climates not all spiders need to be so careful in the preparation and protection of their cocoons, it seems natural, too, that they should use more care in such dangerous conditions, and this presumption is verified by the observations of two men who have lived for two winters in the high arctic region and who have communicated to me the following facts. These men are Biederbeck and Lieut.— then Sergeant — Brainard, of the late Lady Franklin Bay Expedition. Both noticed that a great many leaves, (Biederbeck said nearly all) which in fall lay loose on the ground around the camp were peculiarly curled and in opening them, which required some skill and exertion, they found them filled with a white mass of stuff which resembled threads, saturated with a glue-like matter. The same informants remembered, on having their attention drawn to the fact by the writer, that similar leaves were fastened upon the stems of the Saxifrage and other bushes. I say that they were fastened, because they stuck to the stems in spite of the fierce fall storms.

Here we have the explanation of the possibility of the survival of spiders through the long inclement winter season in the arctic belt.

The reason why so few specimens and species of the large family Attidæ, a family of decidedly cosmopolitan character, have been found to inhabit the arctic region is in my opinion due only to the fact that their mode of hibernating is not suited to the severity of arctic winter. They select, at least in the temperate climates, the spaces between the bark and the wood of large trees; here they spin a thin silken tent or tube which gives ample protection from the frosts of a comparatively light winter. As the opportunity of following this method is wanting in the polar zone, the spider has no chance to preserve its species under the prevailing circumstances.

In answer to a question by Professor Riley, Dr. Marx said that spinning spiders are rare in Arctic regions, and are represented by a few small species. But two Orb-weavers have been found. The occurrence of spinning species was discussed also by Dr. Fox and Mr. Banks.

Mr. Schwarz remarked that the Arctic region not only harbors the so-called circumpolar species, but besides these many species which are local in distribution. In fact the Arctic region is divided into several more or less strongly marked sub-regions, each possessing a number of peculiar species. He said that there must be natural barriers which prevent the spread of these

species and favor the development of local races and distinct species. While, in some instances, the barriers are plainly indicated by intervening stretches of the ocean, it is not easy to point out the barriers on the continents, viz., those which produce the difference between the faunas of eastern and western boreal American or between those of eastern and western Siberia.

Mr. Fernow remarked that animals are dependent on plant life, and, as the latter is much influenced by climate, the local faunas noted probably resulted from climatic conditions, which would vary considerably within prescribed districts, as, for instance, on the east or west coast of continents.

Dr. Gill said that his attention had been forcibly drawn to similar cases of extremely local distribution in Arctic species in other classes of animal life. He mentioned in fishes a distinct order and family, the Delidæ, which have a very restricted habitat, being confined to Lake Baikal, Siberia, and are not known to occur elsewhere, and other similar cases.

Mr. Marlatt presented the following communication:

A STUDY OF THE OVIPOSITOR IN HYMENOPTERA.

By C. L. Marlatt.

A study of the peculiar and, in a measure, abnormally developed ovipositor of *Metopius rileyi* together with an examination of the nature of its attachment to the terminal segments of the abdomen led to some interesting results already recorded in this volume of the Proceedings * and induced the writer to make a series of dissections of the terminal segments and ovipositor of other Ichneumonids and representative species of other families of Hymenoptera. A brief summary of the outcome of this work is given in this communication.

The older writers seem not to have very carefully studied the ovipositor in this order of insects, with the exception of Westwood, who gives a measurably accurate description and figure of this organ in *Pimpla instigator*,† which he says will be found to agree with Uroceridæ and Cynips. Of other writers, he says that Réaumur, De Geer, Curtis, Latreille, Gravenhorst amd Burmeister, who have figured and described this instrument, have failed to trace its true structure.

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* Notes on the genus *Metopius*, etc., p p. 101-105.

† An Introd. to the Mod. Class of Ins., etc. Vol. ii, p. 139.

As a basis for a full understanding of the subject I will reproduce Westwood's characterizations of the ovipositor of *Pimpla*, referring for illustration to my drawings of *Pimpla conquisitor* Say (Fig. 8):

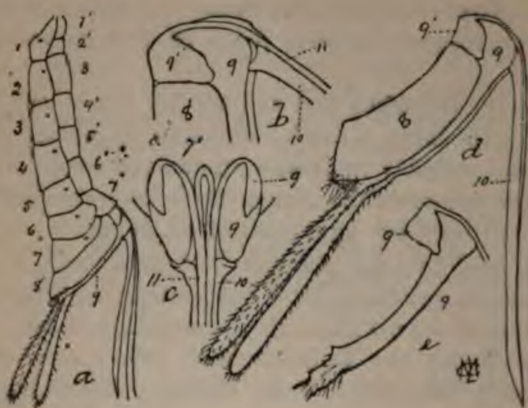

FIG. 8.—*Pimpla conquisitor*: *a*, side view of abdomen, showing ovipositor partly extended; *b*, anterior extremity of ovipositor and supports, showing method of attachment; *c*, ventral view of same; *d*, enlarged side view of eighth segment and ovipositor; *e*, same, with eighth dorsal arc removed, to show shape of support and manner of attachment of the spicule-plate to the latter—all enlarged (original).

"Figure (8) represents a lateral view of the abdomen of the female, * * * exhibiting the eight dorsal arcs (numbered 1 to 8), the seven basal ones being spiraculiferous, the eighth furnished at the tip with two minute styles. On the under side of the abdomen there only exists seven ventral arcs (numbered 1 to 7), from the last of which arises on each side a corneous elongate plate (9) which is the basal portion of the outer sheaths of the ovipositor; the apical part of these sheaths varies greatly in length in the different species, but the articulation always takes place near the extremity of the body. When at rest these two demi-sheaths (which are externally convex and pilose, but internally concave and polished) are brought into contact, and enclose between them the terebra or borer itself, which is a compound instrument formed (like the borer of *Urocerus*) of three parts, the superior (10) being nearly cylindrical and channeled beneath for the reception of the two slender, rigid, filamentous spiculæ (11), with mem-

branous edges transversely striated at the extremity; the union of these three pieces forms a central passage * * * for the protrusion of the egg."

He also exhibits a more highly magnified view of the base of the ovipositor, to show, as he correctly states, "that the superior channel (10) originates from the base of the basal part (9) of the outer sheath."

So far as the ovipositor proper is concerned the foregoing description is correct; but in the manner of the attachment of the latter to the so-called basal plates, and of the latter again to the abdomen, considerable additions and modifications must be made.

The general relationship of these parts was shown in my article already referred to in the figure of *Metopius rileyi*, which I reproduce (Fig. 9). In this insect the ovipositor includes, with supports, the 7th and 8th abdominal segments.

FIG. 9.—*Metopius rileyi*: *a*, female from side; *b*, abdomen of same, showing ovipositor partly exserted; *c*, same, with ovipositor entirely exserted; *d*, *f* and *g*, terminal segments of abdomen and parts of ovipositor still more enlarged (original).

The connection between the base of the support (9) and segments 7 and 8 is very intimate, the lines in the illustration indicating the union of the plates appearing as scarcely perceptible sutures. The support (9) is deeply grooved beneath, or rather consists of two plates, and the ovipositor proper (10) closes into it like the blade of a knife. At the extreme base of the support, and projecting slightly posteriorly, are the hairy sheaths, and at the tip of the 8th segment are the minute stylets found in most Hymenoptera.

The ovipositor proper consists of the customary three parts, viz.: the superior channeled piece, (10) and two spiculæ (11). The base of former is enclosed by and quite firmly attached to the apex of the support, with which it forms a sort of ball and

socket joint (Fig. 5, *d*, *f*, and *g*). The spiculæ branch near the base of the sheath. The inner branches unite, forming a loop, and the outer pass over the enlarged base of the sheath and continue along the upper edge of the support and unite with the triangular plate 9′, which may be termed the spicule-plate. The parts are shown somewhat separated at *g*, to better indicate their relation. The spaces between the spiculæ and the support are enclosed by a membrane, which forms with these parts a closed passage for the egg from the abdomen to the ovipositor proper.

It will be seen that what Westwood terms the base of the support, which is, however, really its apex, and to which the main piece of the ovipositor hinges, is free and does not originate or attach to the 7th ventral arc except by a loose membrane. In fact it is strongly attached only to the 8th dorsal arc, and the two pieces, or plates composing it, are united at the base, forming a true arc, homologous with and doubtless a modification of a 9th dorsal arc, while the spicule-plate attaches to the 8th dorsal arc and corresponds with the 8th ventral arc. The spiculæ are so intimately connected with the latter that they would seem to appertain to the same arc of the 8th segment.

The great size of the parts of the ovipositor in this species make it an excellent example for study and enables one to trace the parts without any difficulty.

An examination of the figure of *Pimpla conquisitor* (Fig. 8) reveals an exact correspondence in structure and relationship of the parts, accompanied, however, with considerable modification in the size of the different pieces of the ovipositor and supports. The comparatively much shorter basal plate (9) greatly reduces the length of the outer branch of the spiculæ as compared with *Metopius*, and brings the spicule-plate (9′) almost to the apex of the supports. The sheaths are much larger and their continuity with the support (9) is shown at *d* and *e*. The manner of attachment of the superior channeled piece of the ovipositor (10), shown enlarged at *b* and *d*, and of the spiculæ, together with the peculiar forking of the latter, is found to be exactly similar to the same features in *Metopius*. In *Pimpla* and most other species examined the inner branches widen and become more or less thin and unicolorous with the surrounding membrane with which they coalesce.

A study of this organ in other Ichneumoids, including the enormously developed organ of *Thalessa*, shows a practical agreement in structure in all.

The Chalcid ovipositor, while exhibiting considerable modifications in the matter of supports and attachment of the superior piece of the ovipositor and spiculæ to the latter, is found to agree in important particulars, as does also that of *Cynips*.

A full agreement was also found in Tenthredinidæ, Vespidæ and Apidæ—the Honey-bee (*Apis mellifica*) being the species particularly examined in the latter family. In the case of the latter two families the terminal seventh and eighth segments and parts of ovipositor with supports are entirely enclosed and concealed in the so-called terminal sixth segiment, which forms a sort of hood or cloaca over them.

We may naturally expect, therefore, to find this structure of ovipositor to be uniform in the Hymenoptera, and it is the writer's intentión to study and figure these parts in representatives of all the families of this order for some future paper.

Professor Riley remarked on the homology of the parts described, stating that he had given the subject considerable attention in earlier years. The parts figured indicated, he said, very clearly the nine joints and subjoints of a typical insect abdomen.

The paper was also briefly discussed by Messrs. Howard and Ashmead.

Mr. Ashmead presented a paper, of which he has furnished the following abstract:

THE INSECT COLLECTIONS IN THE BERLIN MUSEUM.

By Wm. H. Ashmead.

The Royal Berlin Museum, or "Königliches Museum für Naturkunde zu Berlin," is a large. substantially built, stone, fireproof building, three stories high, and occupying nearly a square of ground, situated on the north side of Invaliden Strasse, almost diagonally opposite Louisen Strasse and the Neuer Thor.

The style of architecture is not remarkable except for its simplicity and good taste. The building is situated some distance back from the street, with a small flower garden in front, with plaster or cement walks, and separated from the street by a high iron-railed fence, the entrance being through three large iron gates, one in the middle and one on each side. At the right side of the Museum is a High School, at the left the Geological and Mineralogical Institute, the back portion of the Museum extending back of both of these buildings in the form of wings, the left wing being occupied by the Zoological Institute, under the direction of Dr. Schulze, the right wing by offices, a library, laboratories, and the insect collections.

Naturally, the Museum is well filled with Natural History specimens usually found in such places: stuffed animals, birds, alcoholic specimens of fish, reptiles, and amphibia, and mineralogical, geological, paleontological and ethnological specimens, *et cetera*, and those interested in such things will find here one of the largest collections in the world, but which I cannot treat of here, as the object of my paper is to give some idea of the insect collections.

The Director of the Royal Berlin Museum is Prof. Dr. K. Möbius, a distinguished savant, a good manager, and a most amiable and agreeable gentlemen, who, after reading my letter of introduction from Dr. Riley, showed me every possible attention and virtually placed the collection at my disposal. He introduced me to the custodian, Dr. Karsch, and his assistant, Dr. Kolbe, and I was at once admitted to the collections *ad libitum*.

The insect collections are contained in two large, well-lighted rooms, each 86 feet long by 53 feet wide, on the second and third floors in the left hand wing of the building; the one on the second floor being for the display collection for the public, arranged according to the different orders, in large glass show cases, in which are displayed some of the larger and more showy exotic insects, somewhat similar to the display collection in our National Museum. On this floor, contiguous to this collection, are the office of Dr. Möbius, the library, and the offices of other officials.

The systematic collection, the offices of the custodian Dr. Karsch, his assistant Dr. Kolbe, and others are on the floor above, and to which no one is admitted without special permission. The room occupied by the systematic collections in the different orders, contains several hundred thousand specimens, and one can imagine my wonder and delight on viewing, for the first time, so large and wonderful a collection of exotic insects.

Down the center of this room is a row of pillars against which are built, a short distance apart, iron show cases with large glass doors, in which are shelves of thick glass, upon which is placed the biologic and alcoholic material, viz., lepidopterous, coleopterous, dipterous larvæ, pupæ, eggs, etc.; also, the collections of Arachnida (spiders and scorpions) and the Myriopoda. They certainly make a beautiful display on the glass shelves.

On either side of these cases are the wooden cases containing the systematic collections, arranged in the following order:

Right side—Lepidoptera, Hymenoptera, Diptera, and Hemiptera.

Left side—Coleoptera, Neuroptera, and Orthoptera.

All are arranged in the same size drawers, about 50 by 21 centimetres, or about the size Dr. Riley has adopted for the

arrangement of the Lepidoptera in the National Museum, only they are much more cheaply made, being of white pine, and costing, with glass cover, but five marks ($1.25).

The Lepidoptera begin with the *Papilionidæ* and end with the *Tineidæ*, and fill many hundred cases, the species being from all parts of the world; those from Madagascar, Africa, and Brazil being especially handsome and the most gorgeous I have ever seen.

The collection had been greatly increased recently by the Peter Maassen collection, valued at several thousand dollars. It contained many rare North American species, besides all the types described by Maassen and Weyner in their recent beautiful work, "Lepidopteren gessammelt auf einer Reise durch Colombia, Ecuador, Peru, Brasilien, Argentinien und Bolivien in den Jahren, 1868–'77, von Alphons Stübel."

The Hymenoptera are well represented, except in the families *Chalcididæ* and *Proctotrypidæ*, although I found some very interesting forms among them. All of Klug's types are here, and many from Westwood, Haliday, Walker, Förster, and others.

I saw a ♀ *Dichthadia glaberrima* Gerst. pinned with a ♂ *Dorylus*, evidently captured *in coitu*, and proving these are sexes of the same species. *Dichthadia* is a large wingless ant, not unlike *Thynnus*, and I think the females of our *Labidus* will yet be found to be something similar, and not the female ant *Eciton*, as suggested by Dr. Mayr.

Two species of the genus *Megalyra* seen here and described from New Holland, lead me to differ from the authorities in placing it with the *Evaniidæ*. It appears to me to be a Braconid, exhibiting strong affinities with the *Oryssidæ*.

Among the unnamed material in the Chalcididæ and Proctotrypidæ, it was my good fortune to recognize some very rare and interesting species, only a few of which can be mentioned here.

I found *Chalcis denticornis* Fonsc. placed as the ♀ of *Hippota pectinicornis* Labr., recognized *Thysanus ater* Hal., *Tetracnemus diversicornis* Westw., and *Hybothorax Graffii* Ratzeb. *T. diversicornis* Westw. has not before been reported on the continent, while *H. Graffii* Ratz. is not in the British Museum. Kirby, in speaking of the genus *Hybothorax*, in his revision of the subfamily Chalcidinæ, says:

"Further observations are much wanted on this curious genus, which is parasitic on Myrmeleon; the peculiar form of its metathorax might appear to indicate some affinity to *Dirrhinus*, but it is difficult to form any opinion in the absence of either specimen or figure." The genus is, however, nearer to *Halticella*, but is easily distinguished from it by the lateral

projections of the metathorax, *the unusually short tarsal joints* and in venation ; *the submarginal vein is clavate* and does not reach the costal edge ; the marginal vein is therefore absent.

Another rare Chalcid which I was charmed at discovering was *Eunotus cretaceus* Walk. Walker described it in the Entomological Magazine (vol. ii, p. 298) and placed it with the *Pteromalinæ*. Ratzeburg in Forstinsecten, Band iii, p. 227, 1852, redescribed it under the name *Tritypus areolatus*, from a specimen reared from a Coccid on *Salix aurita*. Förster, in his Entomologische Studien, 1856, ii, p. 63, rechristened it under the name *Megapelte*, as the name *Eunotus* had been given previously by Dejean to a genus of beetles, and briefly described what he supposed was a new species under the name *Megapelte nigriclavus* reared from *Coccus vitis*. Sixteen years later (1872) Walker in his Notes on Chalcidiæ, pt. v, p. 100, restores the name *Eunotus*, and briefly dismisses the subject by saying : "*Megapelte* Först. is another name for *Eunotus* which has also been named *Tritiphus* and is an example of a small but distinct family."

After a careful study of the species I have arrived at a different conclusion from these authorities. I believe there is but a single species, and it is neither a Pteromalid nor the type of a new family but falls naturally in the subfamily *Aphelininæ*, although in its cephalic, antennal and scutellar characters it shows a strong affinity with the Encyrtinæ. It is a closely connecting link between these two groups with the antennæ of an Encyrtid, but with the weak middle tibial spur and the mesonotal furrows of an Aphelinid.

Förster evidently saw its relationship to this group and probably excluded it only because it had 11-jointed antennæ for he remarks : "Nicht blos die eilf-gliedrigen Fühler sondern auch die Kopf und Hinterleibsbildung geben ihr ein eigenthümliches Gepräge. Der ganze Habitus erinnert nicht undeutlich an *Agonioneurus* Westw. (=*Myina* Nees)."

Walker also as early as 1847 (Annals of Mag. Nat. Hist., p. 229) said that it was allied to *Choreius ineptus* Dalm. and *Encyrtus eucopiformis* Kollar.

At some other time I shall probably give additional notes on the Hymenoptera.

Just behind the Hymenoptera are the Diptera, all well arranged and containing many thousand named species, as well as a large amount of new and unworked material awaiting the specialist.

The Hemiptera, except in three or four families, are badly arranged, and a large portion is still unnamed, especially in the Homoptera. Dr. Karsch is making strenuous efforts to bring all into systematic order, but with his other work it

moves on slowly. He has arranged the *Cicadidæ* and *Fulgoridæ*, and these giants of the order make a most beautiful display; some of the tropical forms being really superb. The collection contains over 600 species of Cicadas.

On the opposite side of the room the cases begin with the Coleoptera, and they take up more room than the Lepidoptera. They are entirely under the care of Dr. Kolbe, are well arranged and determined, and in the number of the species lead all the orders, there being over 50,000 species. The most attractive were the longicorns, in which the collection is exceedingly rich. Dr. Horn had recently added to the collection by donating a large series of his types.

Next to the Coleoptera are the Neuroptera, and as this was the first large collection of this order I had ever seen, it was particularly attractive, the African forms being especially fine and showy. It is inexplicable why we have so few students of this order in America.

These were followed by the Orthoptera, and to thoroughly appreciate the great complexity of forms in this order one must visit the Berlin Museum, where unique forms are brought together from all parts of the world, monsters of deformity and no doubt of depravity.

All the families are well represented, especially in the *Phasmidæ*, *Mantidæ*, *Acrididæ*, and *Locustidæ*. There are pretty Katydids with ocellated hind wings, cockroaches from Africa that strikingly recall the fossil trilobites, grasshoppers that look as though a big spider (*Gasteracantha*) were being carried about on their backs, and other oddities that would require a Scudder or a Bruner to describe.

It would pay any one to visit the Museum, and I regret I have not a more facile pen to describe the wonderful richness of the collections.

In conclusion, I give below the number of species in the different orders in the Museum as furnished to me by the custodian, Dr. Karsch:

Lepidoptera	30,000
Coleoptera	50,000
Hymenoptera	25,000
Diptera	16,000
Orthoptera	10,000
Hemiptera	10,000
Myriopoda	2,000
Arachnida	8,000
Total	151,000

Professor Riley said that he had personally examined this and other large insect collections in Europe, and was of the opinion that the British Museum collection was richer and fuller and of more value to the student than any other. Probably none of these collections have increased more rapidly than that of the U. S. National Museum, but this was solely due to the richness of material and the great activity among collectors. Unfortunately the Museum seems to have no funds for the purchase of material and he was constantly under the necessity of declining valuable additions offered, from lack of means to purchase them. Therefore the collection was poor in exotic material and American students were, as a consequence, under the necessity of visiting Europe whenever they wished to do any thorough work—a state of things which is greatly to be regretted, and which we should endeavor to remedy.

Mr. Schwarz said that considering the age of the public collections of the United States they compared very favorably with the much older collections of the European countries.

In answer to a question by Mr. Howard, Prof. Riley said that salaries given the Official Entomologists or Curators of entomological collections at Berlin are very much lower than at the British Museum or in this country. The subject of salaries and the relation of these to living expenses was discussed by Messrs. Fernow, Ashmead and others.

Prof. Riley, under the head of "Miscellaneous Notes," read short papers, as follows:

ON THE INSECTS AFFECTING THE AGAVE.

By C. V. Riley.

I have recently received from a valued correspondent in Texas a series of insects obtained from the Century Plant, or Agave. They were all obtained from the flower-stems of *A. dasylyrium*, the specimens, which I exhibit, including the following:

1. An interesting Cossonid, which evidently forms a new genus and species. I sent the specimen to Dr. Horn, who says it is certainly not one of the described species. He further writes that it appears to be congeneric with the species referred by him with some doubt to *Amaurorhinus*

A Coleopterous larva (Buprestidæ) with its imago, *Thrincopyge alacris*.

3. An interesting Dipterous pupa belonging to the Bombyliids.
4. An Ichneumonid in all stages, *Labena grallator*, which was undoubtedly parasitic upon the Buprestid, *Thrincopyge*.
5. The cocoon of a Mutillid.
6. The male of *Elis quadrimaculata*, showing some slight variation.

A PROBABLE MICROGASTER PARASITE OF ELEODES IN THE IMAGO STATE.

By C. V. Riley.

The number of Microgasters which affect Coleoptera is comparatively small. In Marshall's Monograph of the Braconidæ the following species are mentioned as affecting insects of this order, though there is no record as to whether they have been reared from the larva or the imago.

Apanteles	hoplites	on	Rhynchites betuleti.
"	"	on	Lina tremulæ.
"	breviventris	on	Orchestes quercus.
"	impurus	on	Anthonomus pomorum.
"	lacteus,	on	" "
"	sericeus,	on	Hypera variabilis.

In each case it will be noted that these parasites belong to the genus Apanteles in the Microgasters. I present a specimen of *Eleodes suturalis*, recently received from Mr. C. E. Ward, of Belvidere, Neb. He was out collecting on the 27th of April and found this specimen in the roadway. Benzine did not kill it, so he brought it home alive, keeping it in a cigar box. The next night Mr. Ward found that the edges of the cigar box were lined with cocoons, which I believe to be those of some Microgaster, and which are also exhibited. The habit here illustrated of spinning cocoons in a linear manner along the angles of the box is doubtless exceptional. If my surmise prove true, I believe this is the first parasite of this sub-family recorded in this country as affecting a mature beetle, as the Microgasters ordinarily affect Lepidopterous larvæ. A dissection of the beetle showed that the contents of the abdomen had been pretty well absorbed, and when compared with a normal pinned specimen taken from the cabinet they confirmed the accuracy of Mr. Ward's statements.

OUR AMERICAN OX WARBLES.

By C. V. Riley.

I desire also to present to the Society a few interesting data in reference to the species of Hypoderma which affect cattle in the United States. I have for some time had figures made of *Hypoderma lineata* with a view of more particularly pointing out the differences in habit between it and the better known *Hypoderma bovis*, and the receipt of Dr. F. Brauer's recent communication * is my excuse for bringing the matter now before the Society. Dr. Brauer makes it clear that *lineata* should be considered a distinct species from *bovis*, though other authors, especially Clarke, have considered *lineata* but a variety of *bovis*. An interesting point brought out by Dr. Brauer, however, is, that through some discoveries of the late Dr. Adam Handlirsch (who, by the way, made some most interesting Dipterological observations and discoveries) he has been enabled to prove that *linaeta* occurs in Europe often in the same regions and sometimes on the same animal with *bovis*. It has in fact been obtained from Brescia, near the Tyrol, in Norway, in the Crimea, in the Balkans, in the Caucasus, in Dalmatia, and in England. In North America Brauer quotes it from Texas, and, on Williston's authority, as ranging to Arizona and Northern California, while Walker described it as *Oestris supplens*, from Nova Scotia. Another interesting fact which he brings out is that it inhabits our buffalo. The material in the U. S. Nat'l Museum includes some specimens actually bred from the larvæ which I received from Dr. Salmon, and ten specimens received from correspondents, as the Heel Fly from various points in Texas, and two by the same name from New Jersey, one of which was reported to have been seen ovipositing just above the hoof of a cow. I have five collected specimens from Colorado, one of which differs from the normal type in having a very scanty pubescence on the face. One of the specimens was collected in Southern Georgia, and three are without any locality label. Of the larvæ of different sizes (all agreeing with Brauer's description of *lineata* and the larvæ which are actually connected by breeding with *lineata*) one is from Arkansas, four without date or locality, two from Texas, and two from Illinois. All these data confirm the reference of the so-called "Heel Fly" to *lineata*.

Another interesting question is brought up in this connection, viz., that so far as the material in the Museum is concerned it indicates that *lineata* is by far the most common

* Verhandlungen der Kaiserlich-koeniglichen Zoologish-Botanischen Gesellschaft in Wien. Wien, 1890. Page 590, "Ueber die festellung des Wohnthieres der *Hypoderma lineata* Villers durch Dr. Adam Handlirsch und andere Untersuchungen und Boobachtungen an Oestriden."

species with us; in fact, not a single typical specimen of *bovis* is accessible. From these facts Dr. Cooper Curtice has, in conversation with me, expressed the belief that *bovis* does not occur in North America, but this would be in my judgment an unjustified and rather rash conclusion to draw from the specimens and experience which I have referred to. In connection, however, with the question raised in *Insect Life* by Dr. Cooper Curtice as to whether the larvæ are taken through the mouth and subsequently penetrate to the skin, it may be said positively that all his larvæ found in the œsophageal walls are of *lineata*, and this exceptional position of the larvæ of this species may have some connection with the exceptional habit of the perfect fly of affecting and probably ovipositing upon the heels of cattle.

FURTHER NOTE ON CARPOCAPSA SALTITANS AND ON A NEW GRAPHOLITHA PRODUCING JUMPING BEANS.

By C. V. Riley.

In connection with my communication on this subject at a previous meeting of the Society, I present an interesting letter recently received from Professor Sereno Watson, of the Botanic Gardens at Cambridge, Mass., as follows:

"I enclose herein some 'critters' that I found the other day in an envelope containing the fruit of a Euphorbiaceous shrub from Northern Mexico, which we know for the present as *Sebastiania* (?) *bicapsularis*. This fruit is very much like that of a similar shrub which is reported to be the host of *Carpocapsa saltitans*. Now, I am curious to know whether this is that insect or any relation to it, and I would also like to know whether it is probable that these species of insects confine themselves each to a single species or genus of plants, or whether they do not more probably make use without distinction of the several Euphorbiaceous genera, which bear nearly identical capsules. I have not ready access to the literature of the subject, and now that Dr. Hagen is suffering from ill health I am sure that you will pardon my troubling you with my questions."

Prof. Watson's specimens enable me to speak with certainty of the species which was referred doubtingly in my previous communication to *Carpocapsa saltitans* as infesting the capsules of what is marked in the Department Herbarium as *S. bilocularis*, but which is doubtless the same as referred to by Prof. Watson as *bicapsularis*. The specimens which he sends, though rubbed, proved to be not *C. saltitans*, but an undescribed species of *Grapholitha*, the larva of which genus is known to commonly infest seeds. It is not absolutely certain

that the moth seen by Mr. Howard and Mr. Rose, to which I referred in the previous note, is specifically the same as those sent on by Prof. Watson, but the presumption as to identity is justified, for the work in the capsules is the same in both cases and different from that of *C. saltitans* in the capsules of the other species of Sebastiania to which I have referred. The species may be known as *Grapholitha sebastianiæ*, and I submit a description :

***Grapholitha sebastianiæ*, n. sp.**

Average expanse, 12 to 16 mm. General color, dusky gray, primaries with the costal median area brighter bluish-gray, and with a faint metallic luster; the ordinary eye-patch on the posterior third of the wing circular and not distinctly separated from the rest in color. The costa is conspicuously marked with about eight dark-brown posteriorly-obliquing dashes, alternating with geminate white streaks, the dark dashes broadening towards the apex. The third of these dark dashes from the apex curves uniformly toward the posterior margin and then extends along the margin until it meets a branch of the fifth, the two together bordering the eye-spot and making almost a perfect circle of it. Secondaries quite uniformly blackish-gray.

Described from three specimens reared from the seed capsuls of *Sebastiania bicapsularis*, Watson, from Northern Mexico.

The species is closely related to *Grapolitha caryana* Fitch, from which it is distinguished, however, by the prominent furcate dark streak extending from the fifth costal streak counting from the apex. The coloration of the hind wings in *caryana* is also not uniform, but whitish along the anterior border.

The species would seem to belong, according to Heinemann's Tables, to the sub-genus Coptoloma, the principal character of which is a truncation of the hind wings between the anal angle and vein 2 ; but as I cannot consider this of generic value, I prefer to describe it under the better defined genus Grapholitha.

FIG INSECTS IN MEXICO.

By C. V. Riley.

In connection with the above, and in the same letter, Prof. Watson sent me a fig full of galls, with the following inquiry :

"I also enclose what may interest you, the fruit of a Ficus from Mexico, in which you will find the gall-insect in its perfect winged state. I have examined the fruit of a considerable number of species of the wild figs of Mexico and this is the only instance in which I have found the gall-insect, though the gall-

form of the pistillate flower is always very distinctly developed. Is there more than one species of insect that does this work, and how nearly alike are the New World and Old-World species?"

The specimen interested me greatly, and I had the insects carefully cut out, and although dried and more or less imperfect, they showed in comparison with those collected by Mr. Schwarz from the wild figs in Florida, as follows:

1. Blastophaga, apparently congeneric with the species from Southern Florida, but specifically distinct.
2. Another wingless form generically distinct from No. 1.
3. A winged form belonging either to No. 1 or No. 2.
4. A Chalcid parasite, also distinct from the species found in Florida.

June 4, 1891.

President Marx in the chair. Fourteen members and one visitor present.

William D. Richardson, of Fredericksburg, Va., was elected a corresponding member.

Mr. Howard exhibited a specimen of *[illegible] columbiana*, Ashm., a little Chalcidid of the sub-family Tetrastichinae, and stated that he had observed the flight of this insect with considerable interest. It is capable of strong sustained flight and hovered about his hand for some moments before alighting, holding itself in about the same position and then darting forward with great rapidity. As it flew between his eye and the light he noticed that the body was held at an angle of about 60 degrees from the horizontal. He is not familiar with any published observations on the flight of the Chalcididae.

He also exhibited a very minute Chalcidid, an Encyrtid, from the collection made by Mr. H. H. Smith on the Island of St. Vincent, which bore a label stating that the species had the power of emitting a marked odor which was perceptible at a distance of one foot.

Mr. Marlatt said it was certainly very remarkable if not almost incredible that so minute an insect should be able to emit an odor sufficient to constantly fill a space two feet in diameter.

Mr. Schwarz said that this was not impossible and that certain minute beetles also possessed this power.

Prof. Riley mentioned other examples of very minute insects possessing a very pungent odor, instancing *Corimelæna* and *Anthocoris* on raspberries and blackberries, the odor of which may be detected long before the insect is seen, and this is frequently from very young and consequently very minute specimens.

Mr. Ashmead remarked that the odor on raspberries was also frequently caused by *Triphleps insidiosus* as well as by *Corimelæna*. The young of the former insect is much smaller than even *Corimelæna* and is not much more than half the size of the insect exhibited by Mr. Howard.

Mr. Howard said that Mr. Smith was a very careful observer, and that his statement as to the peculiarity could be implicitly relied upon.

Dr. Fox showed a specimen of an undescribed species of *Phrurolithus*, in which the palpi were intermediate between the normal male and female, the tarsal joint being without processes, as in the female, while the tibial process was distinctly present, but much smaller than in the male. He considered the malformation to be due to a lack of development.

Dr. Marx observed that this monstrosity resulted from an injury to the specimen, which had caused a retardation of the development of the palpi.

Prof. Riley asked whether such an injury would result in a change of the sexual characters, to which Dr. Marx replied that the palpi, which in the young are very simple and alike in both sexes, take on the characteristic enlargements and modifications peculiar to the male sex on the maturing of the insect.

Mr. Fernow made some additions to his previous communication on *Psilura monacha*. He stated that the government of Germany has recently appropriated $350,000 to fight this moth, most of which will be spent on the lime treatment. He also called attention to a monograph on the May beetles of Europe (*Melolontha spp.*), which he said contained a great many facts on the habits and means of treatment of these pests. He mentioned a fact given in this publication, viz., the migration of the larvæ, which he believed to be a new observation. The only method of treating these insects of any value is the collection of the full-grown larvæ, pupæ and adults. He also mentioned

the influence of deforestation on the multiplication of locusts in connection with the recent invasion by these insects of the Island of Cyprus, and similarly also on the multiplication of *Melolontha*, such deforestation favoring the development of these insects.

Prof. Riley remarked that he had no hesitation in saying that the reason given for the increased multiplication of these insects, viz., deforestation, was entirely valid. He referred to the allied question which came up before this Society some time since of the increased multiplication of wood-boring insects resulting from forest fires, and said that it is now well known that the multiplication of many insects, such as May beetles, locusts, etc., is greatly facilitated by the opening of forests by any means, either by the clearing of large tracts or by burning. He referred to the migration of the larvæ of *Melolontha*, mentioning the now well-known fact that such migration is generally due to the undue multiplication of the species, and that the larvæ of May beetles are the last insects that he would have suspected of assuming such a habit. He thought that the migration of these larvæ must have been very limited, as Lamellicorn larvæ are very sluggish, and cannot go more than a few rods at most, unless when, as in the case of *Allorhina*, the larva has the habit of crawling on its back.

Mr. Fernow referred also to the very serious damage of these insects to garden crops in Europe, and mentioned a recent method adopted in France of compassing the destruction of these pests by disseminating a fungus parasite.

Mr. Howard said that it would be very interesting to know whether the migration followed or occurred in a wet season, referring to the traveling of the larva of *Allorhina nitida* after heavy rains.

Mr. Fernow thought that wet weather would have no influence, as the larvæ in question have been found to be able to live in submerged earth for months. He believed also that the migration was in the soil rather than on the surface of the ground.

Mr. Schwarz called attention to the much greater damage occasioned by the larvæ of *Melolontha* in Europe to forests than is occasioned by the *Lachnosterna* larvæ to the forests of this

country. The latter feed for the most part upon the roots of grasses and cultivated plants and do scarcely any damage in forests.

Prof. Riley said Mr. Schwarz was in error as to the small amount of damage occasioned to various trees and shrubs in this country, and referred to the fact that he had seen oaks and lombardy poplars defoliated by the beetles over large tracts of many square miles in the Mississippi Valley. He said also that in nine cases out of ten where grass lands had been destroyed (and the destruction in patches of greater or less extent was of common occurrence), the injury resulted from the presence of the larvæ of *Lachnosterna*. Prof. Riley also called attention again to the cutting of the petiole of leaves by *Lachnosterna*, referred to in a former paper read before the Society, and stated that the damage this season had been very much less than last year.

Dr. Fox presented a paper entitled "A Collection of Spiders from Indiana," in which he gave notes on a number of the species recorded. He stated that quite a number of the species had not before been found in that part of the United States, but that he had not as yet had time to go over the material thoroughly.*

Professor Riley presented some miscellaneous notes, as follows:

He called attention to the injury done to roses in his own and in the grounds of his neighbors by a small beetle, *Colaspis tristis*.

He stated that he had first noticed the injury from this insect the present year, and that the roses had been very largely blighted by its attacks. The nature of the damage consisted in boring or eating into the buds and partly expanded flowers.

He stated that this experience furnished another illustration of a common insect suddenly assuming a new injurious habit.

In connection with the remarks of Professor Fernow, reported above, he gave a brief account of the work of the Commission in Massachusetts on *Ocneria dispar*. He stated that the Commission now has 150 men at work, and that Mr. Sessions, the Secretary of the State Board of Agriculture, is very earnest and anxious to leave nothing undone that will help in the extermination of this threatening pest. Professor Riley also referred

* It was Dr. Fox's intention to prepare this paper for publication, but he has not found time to do so.

to the prejudice against the use of the arsenicals, which has interfered somewhat with the work of the Commission, and which, at the request of Mr. Sessions, he had done his best to remove by a statement of the facts regarding these insecticides, showing that their use, with ordinary care, is free from dangerous consequences to live stock or man. He stated that he believed that most of the cases reported of animals being poisoned by these arsenicals are hardly to be relied upon, and that in most instances he believed the death had resulted from some other cause. He said, in reference to the work of the Commission, that however carefully it might be done, the extent of the territory covered by the insect and the inherent difficulties of the task, made him very doubtful of ultimate success in eradicating the pest. He gave some facts which he had gathered from conversation with Prof. Shaler during his recent trip to Boston, regarding the manner in which this insect had been allowed to escape by Trouvelot. Prof. Shaler had known Trouvelot very well, and said that Trouvelot had left a batch of eggs on a window-sill and allowed them to be blown away.

He also referred to a spider, determined by Mr. Banks as probably *Pardosa albomaculata* Em., which had been found by Mr. Wm. H. Edwards to seize butterflies on the wing. He referred again to the parasite obtained from *Eleodes suturalis*, the cocoons of which parasite he had exhibited and described at the previous meeting of the Society. He mentioned that the imago had since been obtained and turned out to be a species of *Perilitus*, a fact of considerable interest because of the close relationship of this parasite with the one bred from *Megilla maculata*, and described and figured in *Insect Life*, Vol. I, as *Perilitus americanus*. This parasitism of *Eleodes* was not so exceptional, therefore, as *Perilitus* affected a number of Coleoptera in the imago state.

Mr. Howard referred to the Rose insect mentioned by Prof. Riley, and said that the common Rose Chafer had never been brought into the Department from the District, and that although it had occurred abundantly in neighboring localities it seemed rarely to do much damage in the immediate vicinity of Washington. He accounted for this partly by the nature of the soil of the District.

Mr. Schwarz exhibited specimens of *Trichotheca vagans* (Chrysomelidæ, Eumolpini) and pointed out that the femoral tooth of this species is merely a sexual character, the female being entirely unarmed. He also showed specimens of *Xanthonia* 10-*notata* and *villosula* having a very small, but distinct femoral tooth. It would appear, therefore, that the two genera, at least as far as the species in our fauna are concerned, are hardly distinct, the only difference left being the somewhat longer antennæ in *Trichotheca*.

Mr. Schwarz also presented the following paper:

VERDIGRIS IN COLEOPTERA.

By E. A. Schwarz.

Every entomologist knows what verdigris is. He will have found by experience that it is an almost greater destroyer of valuable pinned specimens than the *Anthreni* and other museum pests. Several remedies and preventives have been recommended: 1. The washing of the affected specimens with chloroform or some ether. This is, however, only a temporary remedy and involves, moreover, for the possessor or keeper of a large collection incessant work. 2. Not to pin anything, but to glue even large specimens on to card paper. This precautionary measure is almost universally carried out, but has, of course, many drawbacks, especially in the larger-sized specimens. 3. To use iron pins instead of the common brass pins. This is, of course, a perfect protection, but unfortunately these pins are on account of their softness difficult to handle, and on account of their greater roughness almost unfit for pinning specimens with a hard covering. 4. To use heavily silver-plated pins. This is no doubt also a good preventive, but such pins do not appear to be readily obtainable, and as a matter of fact are not used with us. The Carlsbad pin appears to be less subject to verdigris than the Kläger pin, but the former is objectionable on account of the too soft point. The Kläger pins are most commonly used with us, but it would appear to me that in former years they were of a better quality and less subject to verdigris than they are now. With the Vienna pins, the Deyrolle pins and the English pins I have had no experience.

In the preservation of Coleoptera I have adopted the method of mounting on points of card paper all such species, even those of pretty large size, which, in the experience of others and myself, are subject to verdigris. The families which are not subject

to verdigris are the following: All Adephagous families, Hydrophilidæ, Coccinellidæ, Byrrhidæ, Parnidæ, Heteroceridæ, Dascyllidæ, Lampyridæ, Malachiidæ, Melolonthinæ, Chrysomelidæ (excepting *Donacia*), Tenebrionidæ (excepting *Platydema* and other fungus-inhabiting genera), Lagriidæ, Anthicidæ, Meloidæ, Rhipiphoridæ, Rhynchitidæ, Attelabidæ, Otiorhynchidæ, Curculionidæ. The families consisting exclusively of small-sized species (Pselaphidæ, Scydmænidæ, etc.), which no one would think of pinning, are omitted from this list, and thus the number of those families where precautionary measures should be adopted is in reality not so very large.

A few generalizations which I have drawn from my experience with verdigris in insects may perhaps be of some interest to our younger entomologists:

1. Coleoptera, which, in the larva state, live in the interior of woody and other plants, including fungi, or those which deposit their eggs within such plants, are liable to verdigris. On the other hand, all phytophagous Coleoptera, the larvæ of which live openly on the plants, do not verdigris. So far as my experience goes this rule holds good also for the other orders. Thus the Rhopalocera do not verdigris, excepting the genus *Megathymus* and those Hesperids which are "inside-feeders." The Sphingidæ are free from verdigris, the Sesiidæ badly subject thereto. The Bombycidæ do not verdigris, excepting *Cossus*, *Hepialus* and allied genera. In Noctuidæ only *Nonagria*, *Arzama*, etc., verdigris. In Hymenoptera the wood-boring Uroceridæ are badly subject to verdigris, and the same holds true in the Tenthredinidæ, the eggs of which are inserted within plants, although most larvæ live free. In Neuroptera (taken in the old sense) the only inside-feeding families are the Termitidæ and Embidæ, which, when pinned, are speedily ruined by verdigris. In Orthoptera all families are either not or only slightly subject to verdigris, excepting those Gryllidæ, the eggs of which are laid in the wood. In Diptera such families as Trypetidæ and Xylophagidæ are more subject to verdigris than most other families, and the same may be said of the Aradidæ and Cicadidæ among the Hemiptera.

2. All aquatic families of Coleoptera are free from verdigris. In the Dytiscidæ I do not know a single exception from this rule; in Gyrinidæ, Hydrophilidæ and Parnidæ a slightly verdigrised specimen will occasionally be found in collections, but probably only on account of an exceptionally poor pin. If the Chrysomelid genus *Donacia* (including *Macroplæa*) be counted among the aquatic Coleoptera it forms a striking exception to this rule, for these beetles are among the worst to verdigris. There are no other truly aquatic (*i. e.*, aquatic in all stages) families in the other Orders except in Heteroptera, and, so far

as my experience goes, these are likewise less subject to verdigris than the other families.

3. All dung-inhabiting Coleoptera, no matter to what family they belong, verdigris badly. So far as I can see there is no exception, and this rule can also be extended to the other Orders.

4. Terrestrial predaceous Coleoptera do not verdigris. In Carabidæ the species of *Lebia* and allied genera form an exception, though not a very marked one, but in the predaceous Staphylinidæ the genus *Staphylinus* and certain species of *Philonthus* verdigris badly. It will be seen, however, that these are species the larvæ of which live in dung or decaying fungi.

5. Coleoptera, which in the larva state live in the ground and feed externally on the roots of plants, are either free from verdigris or at least rarely so badly infested that they are ruined. Here belong the phytophagous Scarabæidæ, a portion of Chrysomelidæ (*Eumolpini*, etc.), a portion of the Tenebrionidæ and the Otiorhynchidæ.

6. Myrmecophilous Coleoptera, no matter to what family they belong, verdigris badly. This holds also true of myrmecophilous species of other orders, *e. g.*, the Dipterous genus *Merodon* and the Orthopterous genus *Myrmecophila*. On the other hand Coleopterous parasites of bees do not verdigris. It will be noticed that there appears to be here a correlation between the hosts and their parasites, the Formicidæ being among the worst insects for verdigris while the Apidæ are almost the only family of Hymenoptera which are free therefrom.

7. Old alcoholic specimens, *i. e.*, such as have been kept in alcohol for a year or longer, never verdigris. I have also been informed from reliable source that specimens left in alcohol for a day or two are less subject to verdigris than the same species killed in cyanide of potassium.

8. If many specimens of a species known to be badly subject to verdigris are pinned it will almost always be found that a few specimens remain free from verdigris.

Prof. Riley said that the experience of Mr. Schwarz in the matter of verdigrising was similar to that of all entomologists who had much to do with pinned specimens, and correspond with his own, as exemplified in the national collection. He said that in general endophytous larvæ are subject to greasing, and that greasing was almost always accompanied by the formation of verdigris. In reference to the statement made by Mr. Schwarz that water-bugs do not grease, he remarked that this was only partially true and that certain species grease very

badly, notably *Nematus*. He stated that the fact of verdigrising being invariably associated with endophytous larval life was very interesting, and he believed it to be accounted for by such species having a preponderance of oily or fatty matter. With reference to Mr. Schwarz's objections to iron pins on account of their softness and clumsiness, he stated that he had been impressed with the freedom of a collection mounted on iron pins from verdigris, referring to the collection of Mulsant in France, and stated that if the pins were properly made they can be safely used. The insertion of the pins in hard-bodied Coleoptera may be aided by first piercing the beetles with a sharp-pointed needle, after which the iron pin may be safely inserted. He would recommend the use of iron or black pins wherever there was a tendency to grease, and as a consequence to verdigris.

Mr. Howard asked how soon after pinning verdigris appeared.

Mr. Schwarz replied that in specimens of *Donacia* glued to triangles, verdigris began to make its appearance in about four weeks. Other pinned specimens were very badly verdigrised within less than four weeks. Mr. Schwarz also urged another objection to iron pins, viz., that it is impossible to remove the pin, should this at any time become desirable, without injuring or ruining the specimen.

Mr. Howard made some inquiries as to nature and cause of verdigris, and asked if it were not the result of the action of the acid resulting from decomposition of the oily matter in the insect.

Mr. Schwarz said that oiliness was not always accompanied by verdigris, mentioning in this respect certain water beetles which are oily, but which never verdigris.

Prof. Fernow said that verdigris undoubtedly resulted from the effects of the acids, and recommended the washing of the insects with an alkali to prevent verdigris. He also said that if aluminium pins were used verdigrising would not ensue.

Prof. Riley referred to Mr. Schwarz's statement that oiliness is not necessarily accompanied by verdigris, and asked for the experience of members.

Mr. Pergande said that Pyralid and Tortricid moths which grease badly also verdigris badly and that it was his experience

that oiliness was almost invariably accompanied by verdigris.

Prof. Riley said that oiliness of water-beetles was superficial and was of a sticky nature, and seemed to be different from the oiliness of other insects.

Mr. Austin in explanation of the nature of verdigris said that the decomposition of insects results in the formation of both alkalies and acids, and the combined action of these results in the formation of copper soap or verdigris.

Mr. Stedman reported the results of certain investigations which he had been conducting on the character of the covering of the gills of aquatic larvæ of Diptera, stating that quite contrary to the formerly accepted idea the gills are covered with a thin chitin rather than a non-chitinous membrane. This fact he had established to his own satisfaction in the case of several species, and proposed to continue his observations and present full report later.

OCTOBER 1ST, 1891.

President Marx in the chair. Fourteen members and five visitors present.

Messrs. E. W. Doran, A. G. Masius, F. C. Test and W. T. Swingle were elected active members of the Society; Messrs. H. E. Weed, William H. Harrington and E. A. Popenoe were elected to corresponding membership.

Mr. Heidemann presented the following:

NOTE ON THE FOOD-PLANTS OF SOME CAPSIDÆ FROM THE VICINITY OF WASHINGTON, D. C.

By OTTO HEIDEMANN.

On my excursions in the vicinity of Washington I have, during the past two years, paid considerable attention to the food-habits of Hemiptera-Heteroptera and more especially of the family Capsidæ in which I am particularly interested. Of the many notes which I have thus accumulated I venture to place herewith on record such as relate to Capsids affecting some of our forest and shade trees. The species have been kindly determined for me by Prof. Ph. R. Uhler, of Baltimore. Unfortunately there are among them many undescribed species, and the following list contains quite a number of Prof. Uhler's

manuscript names. It is to be hoped, however, that Prof. Uhler's Monograph of the N. A. Capsidæ, in which these species will be fully described, will soon be published.

1. SPECIES FOUND ON SHRUB PINE (*Pinus virginiana*). *Phytocoris eximus* Reut.—Quite abundant from June to August.

Phytocoris mundus Uhl. MS.—Less abundant, collected during June and July.

Megacœlum grossum Uhl.—Found during July, August and September; not very common. Prof. Uhler took it also on Pine bushes in Maryland, Pennsylvania and Massachusetts during the month of July. (Ent. Amer., iii, p. 71).

Pilophorus amœnus Uhl.—This ant-like Capsid can be found in great numbers on the Pine from the middle of June to August. Prof. Uhler has also recorded it on Pine in June and July in Maryland. (Ent. Amer., iii, p. 30).

Pilophorus crassipes Uhl. MS.—Allied to the former, but more robust, and darker in color; quite common in July, August and September.

Pilophorus lætus Uhl.—Smaller, and easily recognized by the form of the antennæ, the second joint being abruptly enlarged at tip; less abundant than the two preceding species.

Melinna modesta Uhl.—A widely distributed species common upon Pine trees during the whole summer and autumn; I have taken the larva in May.

2. SPECIES FOUND ON RED CEDAR (*Juniperus virginiana*). *Psallus juniperi* Uhl. MS.—A small and very frail insect of light gray color variegated with red. Appears in the middle of June, but is not common. I have also found specimens at Berkeley Springs, W. Va., late in August.

Lygus repletus Uhl. MS.—Has been found in large numbers from middle of June to August. I also took it at Berkeley Springs, W. Va. This pretty insect is quite hard to detect on account of its green color matching exactly that of the leaves of its food-plant, but when seen, it is easily captured, because, contrary to the habits of other Capsids, it does not take wing so readily.

Dichrocytus elegans Uhl. MS.—Less common than *Lygus repletus*; found during June and July. It is easier to be seen from its dark-red color of the corium. The three species just mentioned occur in my experience always in company.

3. SPECIES FOUND ON WILLOW (*Salix nigra*). *Orthotylus alternatus* Uhl. MS.—Abounds on Willow during the month of June, but is less frequently found in July; after that it disappears entirely.

Pilophorus confusus Kirschb.—Not uncommon during July and August. Prof. Uhler found it upon willow bushes in September. (Ent. Amer., iii, p. 30).

Melinna pumila Uhl.—Occurs abundantly in June, July and August. Prof. Uhler found specimens upon Willow as late as the middle of October. (Ent. Amer. iii, p. 70).

4. SPECIES FOUND ON LINDEN (*Tilia spp.*). *Psallus sericeus* Uhl. MS.—Found on *Tilia europæa* and *T. argentea* in the grounds of the Department of Agriculture. Quite common from the middle of June to late in July. This interesting Capsid likes to hide in the withered blossoms, and evidently punctures the forming fruit; it is easily overlooked, as its straw-yellow color does not offer the slightest contrast with the faded blossoms.

Phylus modestus Uhl.—Occurs from middle of May to middle of June; not uncommonly on Linden blossoms.

Camptobrochis grandis Uhl.—Quite common. I have taken the larva in the middle of June on flowers of *Tilia argentea*; the whole body being entirely covered with a white mealy substance. The imago, according to Prof. Uhler, preys on small caterpillars, and occurs also on grapevine. (Ent. Amer. ii, p. 231).

5. SPECIES FOUND ON ASH (*Fraxinus*). *Neoborus pettitii* Uhl. MS.—This Capsid appeared early in the spring of 1890 (May 13th) around Washington in great numbers on native and imported species of *Fraxinus*. During May and June I secured many specimens in all stages of development. I have found this insect again last summer on the same trees but much less abundant than the year before. A. S. Packard found the same species on the leaves of the White Ash at Rangeley, Maine, September 5 and 6. (Fifth Report U. S. Ent. Comm. p. 556).

Orthotylus delicatus Uhl. MS.—A very delicate Capsid of a light green color. I took it from middle of June to July exclusively on *Fraxinus excelsior* in the Smithsonian grounds. It occurred always in company of *Phyllopsis fraxinicola* Först. It is common but hard to capture; when seen, it runs quickly to the underside of the leaf and drops off.

6. SPECIES FOUND ON BLACK BIRCH (*Betula nigra*). *Malacocoris irroratus* Say.—The imago of this common and widely distributed species occurs on many different plants, but I have hitherto found the larva only on Black Birch in June and July.

Phytocoris puella Reut.—Not uncommon in the month of July. Also found on grapevine.

Referring to the above Mr. Schwarz remarked on the very limited number of Heteroptera mentioned in Packard's "Forest Insects," and the consequent importance of such additions as those made by Mr. Heidemann to our knowledge of the Heteropterous enemies of forest and shade trees.

Mr. Ulke exhibited and remarked on the following aquatic Coleoptera found by him during the past summer in the Blue Ridge Mountains, near Monterey, Md.: *Elmis elegans*, hitherto considered a rare species, occurred plentifully in a small brook in a short moss, which, intermixed with sand, covered the under side of stones; *Elmis* n. sp., allied to *ovalis*, found under stones in brooks; *E. nitidulus* and *latiusculus* were also quite abundant, and an examination shows that they are evidently the sexes of one species since they differ only in size and shape; *Cymbiodyta rotunda*, of which since the original discovery by the elder Dr. Melsheimer in the mountains of Pennsylvania, only two or three specimens had been found, occurred plentifully in little pools which were fed by clear, cold spring water.

Mr. Ulke also exhibited the pale or mature female form of a *Phengodes*, which occurred abundantly in the mountains of Maryland.

Prof. Riley said that he was convinced that the specimen exhibited by Mr. Ulke was the true female of *Phengodes laticollis*. He said also that a good deal remains to be learned about these *Phengodes*, and particularly how many of the species had the pale, mature larvi-form females. He stated that ten or twelve different species of the female Phengodes are known. Commenting on the local abundance of particular insects, as illustrated by Mr. Ulke's experience, he mentioned as a further example the finding in extraordinary numbers of the larva of *Photuris pennsylvanica* in a particularly grassy bank near his residence.

Prof. Riley asked if the food-habits of the larva of *Photuris pennsylvanica* are known, to which Mr. Schwarz replied that this point is not positively ascertained, but the supposition is that they feed on snails and insect larvæ.

Mr. Schwarz exhibited specimens of *Emphylus americanus*, found by Mr. H. G. Hubbard and himself in a colony of *Formica sanguinea*, near Alta, Utah, at an elevation of about 9,000 feet. Mr. Ulke added that he had lately received this species from the Black Hills region of South Dakota and from Colorado, and also mentioned a yellow *Tachys*, found always in the nests of a certain ant.

Dr. Marx stated that he had received a new *Hypochilus* from Colorado, sent by Mr. Titus Ulke.

Mr. Ashmead read the following paper:

NOTES ON THE GENUS MELITTOBIA.

By Wm. H. Ashmead.

The genus *Melittobia*, in "Cresson's Synopsis," is stated to have been erected by Prof. Westwood, in the Proceedings of the London Entomological Society for 1849, but in looking up the subject I find it was established two years earlier. In the same publication for the year 1847, page xviii, is the following brief note relating to it: Mr. Westwood exhibited specimens of a minute but very remarkable Hymenopterous parasite belonging to the family Chalcididæ, reared by the late M. Victor Audouin, in the nests of mason bees, near Paris, in which the antennæ of the males are singularly distorted and the wings almost rudimental, thus offering a strikingly opposite analogy to other bee parasites, such as *Stylops*, *Meloe*, and *Sitaris*. Mr. Westwood proposed for this insect the name of *Melittobia Audouinii*. About two years later Mr. George Newport, in one of his celebrated biological contributions, "The Anatomy and Development of certain Chalcididæ and Ichneumonidæ," read before the Linnæan Society of London, March 20, 1849, described what is evidently the same thing under the name *Anthophorabia retusæ* reared from the cells of *Anthophora retusa*, found in a dry clay bank beneath the ruins of the Roman Castle at Richborough, near Sandwich in Kent. In a notice of this memoir, Prof. Westwood, in the Proceedings of the London Entomological Society for 1849, p. lxv, called attention to the fact that the genus *Anthophorabia* was identical with his *Melittobia*, described at the July meeting in 1847; that Mr. Newport was present at the said meeting, heard his description read and saw his types and drawings. He then follows with a full generic description.

Why this description was not published previously, in the Proceedings of the Society for 1847, I do not know, but I think all fair-minded persons will agree with me in believing that of the two names *Melittobia* should take precedence over *Anthophorabia*.

The genus is a peculiarly striking one in the great dissimilarity in the sexes. In the male the wings are rudimental or abbreviated, the eyes are reduced to a single ocellus and the antennal scape is strongly developed, gradually dilated and lobed at apex; the flagellum is very short and twisted and capable of being folded beneath the dilated scape. The female, on the contrary, is fully-winged with normal eyes and antennæ.

This degraded male type is exceptional in the order Hymenoptera, as I am only aware of its occurrence among the fig insects, as Blastophagæ, although it is not unusual in Homoptera and possibly other orders.

Mr. Howard, in his generic synopsis of the Chalcididæ, has placed the genus in the sub-family Elachistinæ, following Thomson's classification, but it plainly does not belong here, agreeing in no essential character with this group. In all the essential characters, except in having two tibial spurs to the posterior legs, it agrees with the Tetrastichinæ: The submarginal vein is distinctly broken, the postmarginal undeveloped; the scutellum with two furrows, while the abdomen is sessile. I therefore propose to remove it to this group.

The first notice of the occurrence of the genus in America was by Dr. A. S. Packard, Jr., who in the Proceedings of the Essex Institute, Vol. IV, p. 13, described *Anthophorabia megachilis*, from the ♀ alone, obtained from the cells of *Megachile centuncularis* Linn, collected by Mr. Putnam at Bridgport, Vermont. Dr. Packard counted upwards of one hundred and fifty larvæ in a single cell.

In the Department Collection there is a single female specimen, agreeing tolerably well with Packard's species, reared by Dr. Riley, November 17, 1877, from the cells of *Anthophora abrupta* Say, collected in Carondelet, a suburb of St. Louis, Mo., which were also infested with a Meloid larva, *Hornia minutipennis* Riley, Dipterous larvæ and mites.

At Jacksonville, Fla., during the month of August, in 1887, I reared a species from the common mud wasp, *Pelopæus cementarius* Drury, to which I gave the MS. name *Melittobia pelopæi;* and Prof. E. A. Popenoe has reared a species at Manhattan, Kans., from the cells of the same insect.

Recently another species was handed me to be determined, reared in quantities from the cells of *Chalybion cæruleum* Linn., collected in Virginia, and which, as far as I can remember, is different from *Melittobia pelopæi*, Ashm., MS. This species I exhibit to-night in both sexes, and have drawn up a description of it under the name *Melittobia chalybii*. The larva of Melittobia, according to Newport, "is completely apodal, of a subcylindrical form, a little attenuated at each extremity, and composed of fourteen segments. The head is small, like that of a wasp or hornet, and the mandibles are short and acute. It occurred in the cells to the number of thirty or fifty in each. I found it not only in autumn, but also in the winter and early spring in this state, but in some cells the larvæ had changed to nymphs before the month of September." Mr. Newport then enters into a discussion of the habits of the insect, the structural characters of the males, etc., which is well worthy of

a repetition here. He says: "The habits of this insect may be inferred from the peculiar organization of the male. From both sexes being found in the closed cells of the bee, and from the absence of a long ovipositor in the female we may conclude that the eggs are deposited while the nest is being provisioned, or immediately before it is closed; and that, like the true Ichneumons, the parent either plunges her eggs into the body of the newly hatched bee-larva or attaches them to its skin. The bee-larva, like many other species similarly circumstanced, continues to feed and grow, and supply nourishment to the parasites; and by the time it has consumed the whole of its provision these also are far advanced in growth. When the young bee is entirely destroyed these are matured and prepared for their changes to the state of nymph, which they assume lying loosely in the cell, without spinning separate cocoons."

"From the circumstance that although both sexes are found moving freely in the cell, the male is by far the least active, and especially from the fact that his organs of vision are merely single ocelli, instead of large compound eyes, as in the other sex, I am led to the conclusion that impregnation is effected before the insects quit their habitation; because ocelli, being different in their structure from the individual parts of the compound eyes, are fitted only for near vision. The difference of structure consists in this: The cornea, or external surface of each part of the compound eye, which is individually as perfect, as an organ of vision, as the ocellus, or single eye, is less convex than the cornea of the latter; while the *chamber* of the eye, or space between the cornea and the termination of the nerve at the bottom of the structure, is of much greater length in the compound eye than in the single. The result of these two conditions is, that the compound eye is fitted for viewing objects at a considerable distance, but with little magnifying power; while the ocellus has great magnifying power, but is fitted only for viewing near objects. The male with his single eyes may thus be regarded as acute, but short-sighted, the opposite of his partner. But this condition is essential to him, and fully sufficient, if, as presumed, the greater portion of his existence is passed in a closed cell, not half an inch in diameter, and from which, perhaps, he never wanders more than to the distance of a few inches. But stemmata or ocelli only would be insufficient for the other sex, who has not only to seek out the proper locality for her eggs, but also to elude the vigilance of the bee in whose nest she is seeking to introduce her own progeny. Instead, therefore, of mere stemmata, the eyes of the female are multiplied, and occupy, as in most other perfect insects, a large portion of the surface on each side of the head."

Melittobia chalybii n. sp.

♀. Length 1½ mm. Black, smooth, shining and pubescent; the pubescence of the thorax black, rest of the body grayish. Head transverse, thin antero-posteriorly; when viewed from in front, oval, the vertex being high and truncate; frons impressed or grooved for the reception of antennæ. Ocelli 3, triangularly arranged. Eyes narrow, pubescent. Antennæ short, 9-jointed, inserted just above the mouth, the scape and pedicel brownish-yellow, the flagellum fuscous, pubescent; the scape is subclavate, the flagellum, including the pedicel, is not longer than the scape. Pronotum large, narrowed anteriorly, triangular; mesonotum a little longer than wide, with two deep parapsidal furrows; scutellum with two deep parallel furrows, the lateral lobes appearing as if carinated; metathorax subquadrate, smooth, shining, with a very delicate or subobsolete medial keel, and the posterior lateral angles lobately produced. Wings gradually narrowed at base, hyaline, pubescent, except a glabrous line extending from the base along the posterior margin to nearly two-thirds the length of the wing; the submarginal vein is distinctly shorter than the marginal vein and distinctly fractured at its junction with the marginal; postmarginal not or scarcely developed, never half the length of the very short, knobbed stigmal vein. Legs brownish-yellow, very pubescent, all coxæ and femora, except the tips, black; tibial spurs 1, 2, 2, short and weak, the inner spurs being scarcely discernible; tarsi 4-jointed, much shorter than the tibiæ. Abdomen sessile, oblong-oval, a little longer than the head and thorax together, and its widest portion being twice as wide as the thorax.

The ♂ is but 1 mm. long and differs from the female in the following colorational and structural differences: The head and legs are pale, brownish-yellow, the scape reddish brown, dusky at tip, the thorax more or less piceous at the sides. The head, when viewed from in front, is transverse oval, being wider than long; the eyes are almost obsolete, being reduced to a single ocellus, while the ocelli are nearly in a straight line. The antennæ are 8-jointed; the scape is very large, gradually and broadly dilated toward the apex, with the sides curving under; above it is therefore convex while beneath it is concave with an apical process at tip within; the very short flagellum, which is not half the length of the scape, issues apparently from the emargination formed by this process, and is often peculiarly twisted backwards within the cavity; the pedicel and the first funicle joint are stout, about of an equal size, the three following joints are not so wide as the first, but are exceeding short and relatively thrice as wide as long, the club is stout and oblong, 3-jointed. The wings are abbreviated and reach scarcely to the middle of the abdomen.

Described from several specimens in both sexes, reared September 14 and 15, from cells of *Chalybion cæruleum*, Linn. Collected in Virginia.

In the discussion of this communication Mr. Howard stated that in his opinion Mr. Ashmead was correct in referring *Melittobia* to the Tetrastichinae, and called attention to the fact that if, as Mr. Ashmead seemed to suppose, this is a primary parasite on Bee larvæ, it offers a striking exception to the rule of hyper-parasitism in this sub-family. He further stated that the rearing of this genus from Aculeata which store pollen, in addition to those which store insects, eliminates one element in the determination of host habit which might otherwise be very confusing.

Dr. Marx presented the following paper:

NOTE ON THE CLASSIFICATION OF THE IXODIDAE.

By George Marx.

While many naturalists, even some of the present day, as Mégnin, Blanchard, Raillet and others maintain that the Ixodidae comprise only the one genus *Ixodes* Latr., or in other words that all species of Ticks ought to be brought into this one solitary genus, C. Koch, on the other hand, recommended that the Ixodidæ should be separated from the order *Acari* and be elevated to the rank of a new order of Arachnida; this new order, which he calls *Ricini*, to be divided into separate families and numerous genera.

This great dissension of opinion is due, perhaps, to the fact that the former naturalists arrived at their conclusion by treating only the forms of their limited indigenous fauna, which consists principally of the species of the genus Ixodes Latr. Koch, on the contrary, acquired a broader and more general view of the group by studying material collected over the whole globe, which enabled him to observe forms that could not be placed in the narrow limits of one genus without utter disregard for the laws of classification; but he failed to show valid reasons for the separation of the Ricini from the other Acari, therefore I do not consider myself warranted in following him in this direction. Koch was, however, certainly right in dividing the heterogeneous material of his Ricini into different families and genera, especially as he also separated the Argasidæ* from the Gamasidæ and brought them into the scope of his new group.

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* Agassiz in his nomenclator substituted *Argantidæ* for *Argasidæ*, but claims that Argas is derived from the name of a *serpent*, the genitive of which is Arg-o—the family name accordingly should be Arg-idæ. For convenience and suitableness I have adopted the old name *Argasidæ* for this family.—G. M.

Koch's families are three: the Argasidæ with the genera Argas,

		Ornithodorus,
Ixodidæ	. . .	Hyalomma,
		Haemalastor,
		Amblyomma,
		Ixodes,
Rhipistomidæ	. .	Dermacentor,
		Haemaphysalis,
		Rhipistoma,
		Rhipicephalus.

This classification is based upon such perfectly natural principles that in studying the American Ticks, of which I have been able to examine a great number, besides many exotic forms, I can do no better than to follow this great Arachnologist with some modifications and additions.

In regard to the systematic value of this group of Arachnida I will consider it as a suborder of the Acari, and, as Degeer, long before Koch, gave the name *Ricinus* to a genus of Pediculi, I propose for this suborder the name *Cynorhaestea*, the oldest name for Ticks, since Homer said: "Enda kuon keit Argos enipleios Cynorhaesteon—there laid Argos, the dog, covered with Ticks."

Aristotle and the old Greeks called the Ticks "Croton" on account of their resemblance to seeds of the Castor tree which bore the name Croton in ancient Greece. The Romans called our animal "Ricinus" for the same reason, for in their language the name of this tree was *Ricinus*, a name which is still used in the scientific botanical nomenclature. (*Ricinus communis* Linné.)

If we admit the family Argasidæ into the Cynorhaestea and hold with Koch that its natural position is here, rather than in the Gamasidæ, on account of the great homology of the mouth parts and other points of undoubtedly close relationship, we have to divide the suborder into two groups—the CATASTOMATA and the ANTISTOMATA.

Suborder CYNORHÆSTEA.

1. Capitulum inserted below the superior or dorsal surface, palpi not excavate at their inner side .... I. group Catastomata
2. Capitulum inserted on a level with the dorsal surface, palpi longitudinally excavate at the inner side, enclosing the sides of the rostrum .... II. group Antistomata

Into the Catastomata I place, in addition to the family Argasidæ, with the genera Argas Latr. and Ornithodorus Koch, the family Eschatocephalidæ, based upon the genus Eschatocephalus Frauenfeld, which seems to form a connecting link between the two tribes. This, however, is provisional.

Group I—CATASTOMATA.

1. Palpi considerably longer than rostrum, cylindrical, 1st palpal joint longest, 4th as long as 3d; not retractile..........family **Argasidæ**
2. Palpi not longer than rostrum, subglobose, 1st palpal joint shortest, ring-like, 4th joint shorter than 3d; retractile..........................
family **Eschatocephalidæ.**
genus **Eschatocephalus** Frfld

Family ARGASIDÆ.

1. Capitulum hidden under a projecting, beak-like prominence, so close to the anterior margin that the tips of the palpi project from under the body and are visible from above...................
genus **Ornithodorus** C. K.
2. Capitulum at least by its length removed from the anterior margin, body without a projecting beak-like prominence in front...........
genus **Argas** Latr

Koch based the criterion of these two genera upon the presence of eyes in *Ornithodorus* and their absence in *Argas*. A close examination, however, of these two genera, which are indigenous in the United States and not uncommon in the Southern and Western States, convinced me that the presence of eyes in *Ornithodorus* is based upon an erroneous observation, and another differentation is therefore substituted.

Argas is so far recorded from Texas, by Prof. Packard, who described it in "Report Geol. Survey, 1873, p. 740," as *Argas americanus*.

I have received, however, a lot from Lakeside, California, where they were found in a chicken-house.

The genus *Ornithodorus* is also found in the Southern and Western States and abundantly also in Central and South America, where it is a great pest to cattle and llamas (Brazil and Chile) and it has been found so far in the United States in Iowa, California and Arizona.

The genus *Eschatocephalus* Frauenfeld has been found, so far, only in caves in Austria. Although the capitulum is inserted below the dorsal surface, the palpi more nearly resembles those of the Antistomata; the family Eschatocephalidæ is therefore provisionally placed in the group of Catostomata.

Group II. ANTISTOMATA.

This group comprises those species which are commonly known by the name of Ticks, and I divide them into three families:

1. Front of the body, opposite the insertion of capitulum straight.........
family **Haemalastoridæ.**
Front of body, excavate..2

2. Rostrum long, palpi longer than broad.....................family **Ixodidæ**
Rostrum short, palpi short, subtriangular, not, or only slightly longer than broad.....................................family **Rhipistomidæ**

Family HAEMALASTORIDÆ.

This family contains the cosmopolitan genus *Haemalastor* Koch., and the European genus *Sarconyssus* Kolenati, the latter found in caves in Austria.

a. Last palpal joint longest and thickest...........genus **Sarconyssus Kol.**
b. Third palpal joint longest and thickest.........genus **Haemalastor** C. K.

Family IXODIDÆ.

1. Body oblong oval, stigmal plate circular, peritreme round, stigma round, punctiform, maxillary armature extending down to the base of maxillæ; male without lamellæ at posterior ventral area..genus **Ixodes** Latr.
Stigmal plate reniform, peritreme comma shaped, stigma oval........2

2. Body nearly circular, male and female shield ornate, palpi long and slender, maxillary armature extending only half way down, male without lamellæ at the posterior ventral area. ....
genus **Amblyomma** Koch
Body like Amblyomma, stigmal plate with an overlapping corner, maxillary armature extending to the base of the maxillæ, male with prominent lamellæ at the posterior ventral area................
genus **Hyalomma** Koch

The genus *Ixodes* Latr. seems to be originally a European form, since it is there represented by numerous species and appears to be in many regions the sole representative of this suborder. In the Western Hemisphere, so far as is known, it occurs only in North America, and is here represented by two species.

The genus *Amblyomma* on the contrary appears to be essentially American, and its many often brightly-colored species are found abundantly in both North and South America.

The genus *Hyalomma* inhabits principally Africa, but a species has been found on a Land-turtle in England, one from the Galapagos Islands (host unknown), and a third one upon a Land-turtle from Florida (Indian River).

Family RHIPISTOMIDÆ.

1. Capitulum drawn out laterally into a sharp point. Eyes present....2
Capitulum with straight sides. Eyes sometimes wanting.................3

2. Second and third palpal joints drawn out laterally into a sharp point.
genus **Boophilus** Curt.
Second and third palpal joints straight, not drawn out...... ....
genus **Rhipicephalus** Koch.

3. External border of palpi straight. Eyes present........................ genus **Dermacentor** Koch
External border of palpi drawn out into a projecting point. Eyes wanting..4

4. External border of second joint drawn out into a sharp projecting points at the base..........................genus **Rhipistoma** Koch
External border of second joint drawn out in a more rounded form.... genus **Hæmaphysalis** Koch

The new genus *Boophilus* of which the type species is *bovis* Riley * is distinguished principally by the peculiar shape of its palpi, which are very short, stand a little apart from the rostrum, and are somewhat zigzag shaped at their external border. It is very probable that *Hæmaphysalis rosea* Koch, from the West India Islands, and Megnin's *Ixodes Dugesii*, from Egypt, of which I possess several males and females, belong to this new genus; as this latter species does not show any difference from *bovis* Riley it must be considered a synonym of the latter.

The genus *Rhipicephalus* is represented in North America by a beautiful species from California and one from Cape Disappointment, Washington. It seems, however, by the number of species described by Koch, to be principally an inhabitant of Africa.

Dermacentor is a common form in North America. Peter Kalm and Linneus have described it as *americanus* from the United States. It occurs everywhere, and I have specimens from Ft. Simmo, Ungava Bay, Labrador, 58° 11 L., and from Sitka, Alaska, and also from the Indian River, Florida It is known here as the dog tick.

Rhipistoma has so far only been found on the genus Lepus, in North America. It is quite common in Kansas, Texas, and California; it is also frequently met with in Austria.

Hæmaphysalis has not yet been found on the American continent; I have it from France and England.

Quite a number of other genera have been established by numerous writers: *Xypihiastor* Murray, *Cecidopus* Karsch, *Adenopleura* McAllister, *Gonixodes* Dugès, *Phautoixodes* Berlese, and *Gekobia* Berlese.

Some of these genera are synonyms and the others are described so vaguely that it is impossible to recognize them.

There followed a long, interesting and animated discussion on the laws of zoological nomenclature, having particular ref-

*See Prof. Gamgee's "Report on Diseases of Cattle," U. S. Department of Agriculture Special Report. 1869.

erence to the facts brought out in a paper read by Mr. Ashmead. Messrs. Riley, Gill, Schwarz, Howard, Ashmead, Marx and others participated in the remarks.

Mr. Howard read the following note:

APPEARANCE OF MEALY BUGS PARASITIZED BY LEPTOMASTIX.

By L. O. Howard.

A species of the encyrtine genus *Leptomastix* which I described in 1885 as *L. dactylopii* is a not uncommon parasite of the common mealy-bug of the greenhouse in Washington. It was reared in large series in the Division of Entomology in 1884, and although not observed since, it is probably only because we have not looked for it. Miss Lillie Sullivan has found it the present season infesting mealy-bugs upon house plants at her residence on R street, and informs me that she can at once recognize infested scales by the fact that they lose almost entirely their waxy or meal-like covering and swell up into yellow objects closely resembling dipterous puparia. She has shown me several from which the parasites have emerged and I have been greatly struck by this resemblance, which is heightened by the fact that the parasite in issuing cuts off a cap at the end of the scale insect, just as the dipterous insect forces off the end of its puparium. This is an abnormal habit so far as I know, as allied parasites are accustomed to gnaw holes through their hosts, removing the epidermis in small particles and leaving no cap. The resemblance of the swollen mealy bug to a dipterous puparium is so strong that only by close search with a strong lens can the observer, by finding the minute legs and antennæ, be certain of its identity.

Prof. Fernow gave a report on the results in Europe of the use of the new insect lime to which he had called the Society's attention at a previous meeting. He has furnished the following abstract of his remarks:

RESULTS ON WORK AGAINST PSILURA MONACHA IN EUROPE.

By B. E. Fernow.

[Author's Abstract.]

Mr. Fernow gave further account of the use of insect lime against *Psilura monacha*. Tar bands had been employed in single cases against it in 1829, and ten years later against

Gastropacha pini, but a general trial of these means against the latter pest did not appear to have been made until 1868, and in the same year the present "insect lime" was invented and manufactured by Schindler & Mutzell at Stettin, Soap and Candle Makers, which obviated the objections to the use of tar.

There are now more than a dozen firms engaged in producing preparations of this kind.

The effect of the bands is not to catch the larvæ but probably due to the odor, which keeps them from passing the band, the caterpillars collecting in masses below it. This observation has led to a system of quarantine by surrounding infested areas with poles covered with lime over which the caterpillars do not pass.

Besides the simple spattle originally used to put on the lime, there are now fifteen different contrivances described, and several apparatus for smoothing the face of the bark where the band is to go. (Some of these machines were described and drawings exhibited.) The cost of liming old trees per acre of forest inclusive of material is from $1.00 to $3.00, the lime costing about $2 per one hundred pounds—forty to seventy pounds being needed per acre.

The latest method of using the lime, commendable for orchard and park trees, is by a piece of rope, first impregnated with tar oil and then covered with the lime. An apparatus for fastening the rope around the trunk enables two men and a boy to cover 1,000 trees in two and one-half days.

According to Altum, the lime has been used with success against the following insect ravagers: By smearing on egg colonies and preventing their hatching against *Ocneria dispar*, *Leucoma salicis* and *Orgyia pudibunda*; by daubing infested parts against *Cecidomyia saliciperda*, *Hylesinus fraxini* and *micans*, *Grapholitha zebeana* and *pactolana*; by bands against *Gastropacha pini*, to fight which this method was invented, also against *Psilura monacha*, *Cheimatobia brunata*, *Hylobius abietis*.

Prof. Riley presented a paper entitled "A New Herbarium Pest," in which he described the transformations and habits of a small Geometrid Moth (*Carphoxera ptelearia* nov. gen. et sp.) which during the last two years has seriously infested and damaged the herbarium specimens in the Botanical Division of the Agricultural Department. These larvæ were first noticed on plants from the Southwest U. S. and have confined their work in the main to plants from that section, but are also spreading to Eastern plants.

A list of the particularly infested plants, furnished by Mr. Dewey of the Botanical Division, was given. A description of the insect, which is a new species and will require a new genus for its reception, was given, and figures of all stages were exhibited. Various means for the control of this pest were given.*

Prof. Riley gave some additional notes on *Panchlora viridis*, in which he referred to the receipt of two additional specimens, one from Gustave Gutenberg of Pittsburg, and the other from Carl Gissler of Brooklyn. The first of these shortly after capture gave birth to a number of living young and afterwards extruded an imperfect egg-cluster, including a number of unhatched eggs; and the other on dissection was found to contain a perfect egg-cluster with the young nearly mature and ready to emerge.

This egg-cluster, which differs widely from that of other roaches, was described and a figure of it exhibited.

Prof. Riley described the modification of the abdomen in *Panchlora* which afforded the space necessary for the escape and pre-natal development of the young within the abdomen.

The enveloping egg-sac of other roaches was in this species reduced to a scarcely-discernible pellicle which did not cover the eggs entire, but was limited to the inner or concave half of the egg-mass.†

November 5th, 1891.

President Marx in the chair. Fifteen members present.

Messrs. Theodore Gill and C. W. Stiles were elected active members of the Society. Rev. C. J. S. Bethune, of Port Hope, Canada, and Prof. H. A. Morgan, of Baton Rouge, La., were elected corresponding members.

Under exhibition of specimens and short notes, Mr. Schwarz exhibited some fine and complete examples of the galleries made by *Hylesinus sericeus* in the bark of *Abies menziesii*, from the Wahsatch Range of Utah. These galleries closely resemble those made by the species of *Scolytus*.

Dr. Marx exhibited two remarkable spiders occurring in our

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* *Insect Life*, Vol. IV, Nos. 3 and 4.

† Published in detail in *Insect Life*, Vol. IV, Nos. 3 and 4.

fauna: (1) a representative of a South American genus, *Nops*, characterized by having but two eyes; and (2) a puzzling species, the affinities of which he pointed out. It resembles an *Epeira*, but it is altogether different in generic characters.

The corresponding Secretary read a note by Mr. Wm. D. Richardson, Fredericksburg, Va., corresponding member of the Society, as follows:

NOTES ON LEMA SAYI.

By William D. Richardson.

Early in June of this year a single specimen of *Lema sayi* was swept from low herbage near a pine wood about two miles south of Fredericksburg, Va.; on July 16th two specimens were noticed on Elder. August 5th they became quite common and increased in abundance until late in the month when protracted rains caused them to nearly disappear, but they reappeared with the clear weather that followed in September, and were observed as late as October 3d. Owing to their great activity, and from the further fact that they would alight on any convenient object after being disturbed, the discovery of the food-plant was difficult. Besides this, the bank of the ditch where the beetles occurred abounded in a great variety of plants, many of which showed evidence of depredating insects. August 19th, however, the larvæ were found in several stages of development on *Commelyna virginica*, the leaves of which had many holes eaten in them by the imago. The eggs are deposited singly in the folds of the central leaf enclosing the flower stalk; they hatch in three or four days; the larvæ are pearly white with a black spot on the top of the second segment; they eat down into the soft stalk, rarely extending their burrows more than 50 mm. The mouth of the burrow is always surrounded by excrement as the larva backs to the top of its burrow and ejects its fæces outside. A few larvæ (nearly grown) were found without burrows, having just commenced eating the crown of fresh plants; these always had a zig-zag band of excrement covering about a third their width and extending to the head. The color and marking of the larvæ does not vary with age, and when fully grown the larvæ are about 7 mm. long. I did not succeed in securing pupæ.

Mr. Schwarz said that *Lema sayi* was one of our most uncommon species and that it had been found by Mr. Ulke many years ago near Washington, since which time it has never been seen here. From Mr. Richardson's observations it would ap-

pear that the natural history of *L. sayi* differs in some important points from that of *L. trilineata* as described by Dr. Harris. In the latter species the eggs are laid in groups, and the larvæ do not bore but live openly on the leaves.

Mr. Schwarz exhibited specimens of a Monommid beetle found by him on dead branches in the semi-tropical forest along the shores of Biscayne Bay, Florida. The species differs at once from *Monomma* and *Hyporhagus* by its two-jointed antennal club and the form of the antennal groove, which is semi-circularly curved and confined to the anterior portion of the thorax. The eyes are contiguous, at least in the male, and the elytral epipleura grooved for the reception of the hind femora.

From a careful study of Dr. Champion's description of the Central American *Aspathinies ovatus*, Mr. Schwarz felt convinced that the Floridian species did not differ therefrom, not even specifically.

Mr. Schwarz also read the following paper:

TIME OF FLIGHT IN LACHNOSTERNA.

By E. A. Schwarz.

The genus *Lachnosterna* has of late years often been discussed before our Society, and the strictly nocturnal habits of these May beetles frequently been referred to. In fact, I have never heard that any of our numerous eastern species leave their subterranean retreats before it gets quite dark. Thus, here around Washington they do not commence to fly before 8 o'clock in the last week of April, not before half-past 8 a fortnight later, and so on. In 1875, while in camp at Haulover Canal, in Florida, I had occasion to observe *Lachnosterna æmula*, which in the earlier part of March was flying about after dark, but also in the early morning, when it was still so dark that the flying beetles could only be heard, but not seen. Some of our more northern species may possibly have the same habit, but no observations are on record so far as I am aware. Another species, *L. crassissima*, was observed by me on June 13, 1878, flying in great numbers over the prairie at Plum Creek, Nebraska, shortly after sunset, when the beetles could still be plainly seen; in other words, about one hour earlier than our eastern species. This slight deviation in habit is probably caused by the difference in the food-plants. Our eastern species feed, so far as known, only on the foliage of trees and shrubs, while this species must feed on grass or some other low herbage, for there were neither trees nor shrubs for several miles around the spot

where the beetles were flying. The dew wets the low plants soon after dark, and on account of this the beetles apparently fly earlier, when the plants are still dry.

Now, if any one had told me that we had in our fauna a Lachnosterna which was flying about in broad daylight in the company of butterflies and bees, I would not have believed it, but at least one such species really exists and was observed by Mr. H. G. Hubbard and myself in the alpine region of the Wasatch Mountains, in Utah. It constitutes, apparently, a new species of the *fusca* group. The first specimens were seen on June 28th, right within the little mining camp of Alta, situated at the head of the Little Cottonwood Cañon, about 9,000′ high. At the time of our visit this region was still full of snow, and the Lachnosternas—all males—were slowly flying close to the ground over those spots where the snow had melted away. A few aspen and willow shrubs and some herbaceous plants had already acquired foliage, but we never saw one of the beetles settle down. This was precisely at half-past six in the afternoon; temperature at 6.35, 52°. The sun was still brightly shining, but it was observed that the Lachnosternas flew only in the shadow thrown by the steep mountain side. On June 30th other specimens were seen at the very crest of the range in an altitude of about 11,000′. This crest is here marked by a great snow drift, forming a vertical wall on one side, and in the shadow of this wall, at 6 o'clock p. m., one of the Lachnosternas was flying about, while a quarter of an hour later several other specimens were seen on the other side of the wall in the shadow of a mountain spur. There was no vegetation in this locality at this season, and the temperature was much lower than at Alta, though we had then no thermometer. The only explanation I am able to give for this remarkable deviation in habit is that the very low temperature (below freezing point), which sets in in these altitudes soon after sunset, prevents the beetles from flying after dark.

The time of flight in insects, viz., whether they are diurnal or nocturnal, appears to be of a subordinate importance in the biology of insects; still when we see that in several Orders the unity in flying habit is maintained even so far as entire families are concerned, it must be conceded that this habit depends on certain peculiarities in the structure of the eye, or other sense organs. In Lepidoptera the unity in flying habit is strictly maintained in the families composing the Rhopalocera and more or less strictly so in some families of the Heterocera, *e. g.*, the Sesiidæ which are strictly diurnal in contradistinction to the Sphingidæ which are strictly crepuscular or nocturnal, excepting the genus *Macroglossa*. The same may be said of entire families in Hymenoptera, Diptera and Orthoptera. In other

Orders this general rule is less strictly adhered to and least of all, I think, in the Coleoptera. Here I cannot point out among the larger families a single one which is strictly nocturnal, and only one, the Buprestidæ, is strictly diurnal, while the Chrysomelidæ and Coccinellidæ are almost entirely diurnal. Among the smaller families several could be mentioned in which the unity in flying habits is adhered to, but in most of the larger families this unity is not maintained, and what, *e. g.*, in a portion of the Lepidoptera is an accessory family character, becomes in most Coleopterous families a character for minor groups, sometimes for tribes or groups or genera or even only a specific character, and sometimes a character of no value whatever, *i. e.*, many species have the faculty of flying both at day and night time. In general it may be said, however, that in Coleoptera a certain uniformity is maintained for genera and often for higher groups. I have attempted to draw up a list of the Scarabæidæ showing how this biologic character varies in a single large family. If I knew exactly the habit of every species such a list would be of considerable interest, but since I am not acquainted with the flying habits of quite a number of genera, it has remained rather fragmentary and I give it herewith as much condensed as possible:

Subfamily Scarabæidæ Laparosticti.—The genera are nocturnal, rarely crepuscular, with the following exceptions: Certain species of *Canthon*, *Aphodius*, *Atænius* and *Trox*, which are both day and night flyers. *Nicagus* is the only strictly diurnal genus of this subfamily, but belongs, perhaps, to the Lucanidæ.

Subfamily Melolonthidæ.—The Laparostict genera, viz: *Amphicoma*, *Oncerus*, *Chnaunanthus* (and no doubt also *Podolasia*) are strictly diurnal. In the Pleurostict genera there is great diversity. Strictly diurnal are: *Hoplia*, *Dichelonycha* (and probably *Cœnonycha*) and *Macrodactylus*. *Hypotrichia* is both diurnal and nocturnal. Strictly nocturnal are: *Diplotaxis* (and probably also the genera allied thereto), *Lachnosterna* (with the exception noted above), *Listrochelus*, *Polyphylla* and probably also *Thyce* and *Phobetus*. In *Serica* some of our species, viz., *S. vespertina* and *holosericea* are nocturnal, while others, *S. iricolor*, *trociformis* and at least one of our western species, are strictly diurnal.

Subfamily Scarabæidæ Pleurosticti.—The genera are strictly nocturnal with the exception of *Strigoderma* and all genera of the tribe Cetoniini excepting *Osmoderma*.

In the discussion Mr. Marlatt stated in reply to the statement by Mr. Schwarz that the species especially noted in Utah was observed flying over grass, and in the absence of trees or shrubs

probably fed on the grass, that he was familiar with a hirsute species (*L. rubiginosa* Lec.) in Kansas which was very abundant in the early evening about the 1st of June on a low perennial plant (*Ceanothus americanus*), and he thought it very possible that the species observed by Mr. Schwarz would be found to feed on some low perennial and not on grass, especially as grass had never been recorded as a food-plant of adult Lachnosternas.

Mr. Mann remarked that various day-flyers are frequently attracted to the light and referred to the fact reported by Scudder of the flight at night of butterflies.

Mr. Schwarz said that by no means every insect attracted by electric and other strong lights could be considered as a night-flying species. The rays of light awakened many day-insects in their resting places in the vicinity of the light and these insects would then naturally fly towards the light, but they would rest quietly during the whole night if there were no lights near by.

Mr. Howard remarked that perhaps some of the beetles considered as night-flyers were so classed simply on the fact of their being commonly attracted to light.

Mr. Mann also referred to the migration of butterflies as a further illustration of the night flying of insects commonly considered to be diurnal in habit.

Mr. Schwarz said that this should be considered not as the normal, but as a seasonal habit and had an entirely different explanation.

Mr. Howard read the following paper:

THE HABITS OF MELITTOBIA.

By L. O. Howard.

In Mr. Ashmead's interesting paper upon this curious genus of parasites, read before the last meeting of the Society, the question of the priority of this genus over Anthophorabia Newport is once more brought up. There should be no question as to the priority of Newport's name; it does not date from the publication of his description in the Proceedings of the Linnean Society of London, but from the Gardener's Chronicle for March 24th, 1849. With the morality of Mr. Newport's course we have nothing to do. The question resolves itself to

the acceptance of the Gardener's Chronicle as a medium for scientific description, as to the identity of the two forms, and as to the sufficiency of Newport's description. Westwood and Newport themselves had a polemical discussion of the matter in the Annals of Natural History, Vols. III and IV, and their relative descriptions were published in this periodical as well as in the Gardener's Chronicle, Proceedings of the Linnean Society of London, and Transactions of the Entomological Society of London. In the general opinion of naturalists, the Gardener's Chronicle was at that time a valid medium. Fred'k Smith has vouched for the identity of the forms, and although Newport's description of the female is indefinite, that of the male is unmistakable. The few words published by Westwood in 1847, however accurately we now know the insect to which he referred, would never be considered by a systematic zoologist of to-day as competent to fix a generic name. They were in fact, not so intended.

Mr. Ashmead's paper being mainly structural, a resumé of the habits of this curious parasite will be appropriate at this time. The first mention occurs in Westwood's Introduction to the Modern Classification of Insects, Vol. II, p. 160 (1840), in which he gives an account of the transmission of specimens to him by Audouin, who had found them in the provisioned nests of Odynerus, Anthophora, and Osmia. The second mention is that of Westwood in the Proceedings of the Entomological Society of London for 1847, p. xviii. Then followed Newport's and Westwood's descriptions previously referred to, the most important, biologically, of these contributions being the first one by Newport in the Proceedings of the Linnean Society. In this paper he states that his personal observations dated back to August, 1831, and we cannot doubt that after having known these insects so long, his desire not to be anticipated in publication by Westwood, whose possession of facts he first became aware of at the meeting of the Entomological Society of July 5th, 1847, induced him to rush hastily into print in the Gardener's Chronicle, and placed him in the very unenviable light to which Mr. Ashmead has called such strong attention, 43 years later. Newport found the larvæ filling the cells of Anthophora, of the larvæ of which scarcely a vestige was left. In the paper read before the Linnean Society February 3d, 1852, he details finding the larvæ of the parasite attached to the larva of the bee in November. They were minute in size, and were not observed to grow during the winter. He thus considered Anthophorabia a primary parasite.

Frederick Smith, in the Transactions of the Entomological Society of London for 1853 (new series, Vol. II, p. 248) details a series of observations by himself upon the same insect. He

found the parasitic larva feeding upon Monodontomerus, itself a primary parasite of Anthophora. His observations were full and undoubtedly correct. No more than three eggs or larvæ were found upon a single host larva, and 12 or 14 days appear to be the time occupied in feeding. He reared the adult insects and found that the male lives on an average seven weeks, and is very salacious, copulating with several females. The males were few compared to the females, and as they are wingless they must necessarily be long lived. He found that the Melittobia preferred the primary parasite to the bee larva. He placed larvæ of the Monodontomerus and also of the bee in a box with the Melittobias, and found that they invariably first attached themselves to the cells containing the parasitic larvæ, although in a number of cases they also oviposited upon the bee larva. The females continue egg-laying for a long time (42 days). Smith expresses the opinion that Melittobia and Anthophorabia are identical.

That careful observer, Dr. J. Giraud, in the Annales de la Société Entomologique de France for 1869, pp. 151-156, gives a series of observations upon the same insect made by himself near Vienna and Grenoble. He proved to his perfect satisfaction that the insect prefers to lay its eggs upon primary parasites in the cells of bees rather than upon the bee larvæ. Thus he observed them feeding upon the larva of Monodontomerus again and also upon the larvæ and pupæ of Leucospis, a Chalcidid which attacks various mason bees. He has reared the Melittobia from the cells of the following genera of Aculeata: Chalicodoma, Stelis, Osmia, Anthidium, Bombus, Trypoxylon, and Odynerus. He found that the eggs hatch in eight days and that four or five larvæ remain attached to each host larva, whose body began to diminish in size. Fifteen days afterwards they ceased to feed, transformed to pupæ and in eight days transformed to adults. He was able to follow three generations in the space of three months. Smith had remarked upon the large size of the eggs, but Giraud states that after being deposited they acquire a turgescence which augments their volume. The presence of the eggs upon the body of the host larvæ appears to cause no inconvenience, and after they have been removed with tweezers the host successfully transforms. Giraud found it difficult to understand how these little parasites, which have only a very weak and short ovipositor, could reach the larva upon which they oviposited. To penetrate a hard parchment-like cell such as that of Chalicodoma or other bees and to reach the larva which does not always exactly fill the cell appeared to him beyond their power, but he found that the female after walking around upon the intact cell for awhile

finally stops at a given point and begins to gnaw the membrane until a perforation has been made. She then crawls through this hole into the cell and deposits her eggs upon the body of the larva, remaining inside and continuing oviposition for several days.

Another host-insect was added by Sir Sidney Saunders, who exhibited before the Entomological Society of London in 1880 specimens of Melittobia reared from a briar inhabited by *Prosopis rubicola* (See Trans. Entom. Soc. Lond. 1880, Proc. p. xvii).

With Packard's observations upon the species which he found in this country parasitic in the cells of the leaf-cutter bee (Megachile) we are all familiar. It is noteworthy, however, that with the species which he described as *Anthophorabia megachilis* 150 larvæ were found clustering upon the outside of the dead and dry bee larva, thus establishing primary parasitism with this species. This extraordinary number of specimens upon a single host larva is very remarkable in view of the observations of Newport, Smith and Giraud. Packard also records a rearing from the cells of Ceratina.

Mr. Ashmead's paper adds two entirely new hosts in Pelopœus and Chalybion, and, as I pointed out at the last meeting, were it not for the earlier rearings of European workers, the true host relations would be difficult to ascertain on account of the heterogeneous nature of the contents of these mud-dauber cells. Mr. Ashmead did not ascertain whether with these wasp-cells the parasitism was primary or secondary.

Mr. Ashmead also mentions Professor Riley's rearing of *A. megachilis* from the cells of Anthophora in 1877, and it is interesting to note that Professor Riley also reared a Monodontomerus from the cells of the same insect.

A most interesting variation in the habits so far recorded has been contained in Prof. Riley's unpublished notes bearing on the life-history of Hornia and Anthophora for the last thirteen years and has not before been published. It is here mentioned with Dr. Riley's permission. On October 9, 1877, a number of dipterous puparia were found in the cells of *Anthophora retusa*. In April and May, 1878, a number of the adults issued and proved to belong to the genus *Syllegoptera*. Previously, however (Mar. 18), a number of *Melittobia* parasites issued from the puparia and were mounted.

This very remarkable variation in habit was not to remain unique, however, for on September 25, 1891, Mr. A. N. Caudell, of Indian Territory, sent in to the Division of Entomology specimens of the same species reared by Mr. Ashmead from Pelopœus, which he had also reared from a mud-dauber's cell. He, however, had broken open the cell and had

discovered that the parasite came from the *puparium of a dipterous insect* occurring therein. He did not succeed in breeding the dipteron, although it occurred very abundantly in the mud-daubers' nests, but sent four of the puparia from which specimens of the parasite issued both on the journey and after receipt. Forty-one specimens were reared after their arrival in Washington, four being males and the rest females. They were observed in copulation, and both sexes appeared to be very active.

I append a tabulated list showing the host-relations of the different species.

TABLE OF THE HOST RELATIONS OF ANTHOPHORABIA-MELITTOBIA.

Host.	*Species.*	*Observer.*
Anthophora	A. acaste (Walker)	Audouin.
		Newport.
		Smith.
		Giraud.
Osmia	"	Audouin.
		Giraud.
Odynerus	"	Audouin.
		Giraud.
Chalicodoma	"	Giraud.
Stelis	"	"
Anthidium	"	"
Bombus	"	"
Trypoxylon	"	"
Monodontomerus	"	Smith.
		Giraud.
Leucospis	"	"
Prosopis	"	Saunders.
Megachile	A. megachilis (Packard).	Packard.
Ceratina	"	"
Anthophora	"	Riley.
Monodontomerus	"	"
Pelopœus	A. pelopœi (Ashmead)	Ashmead.
Chalicodoma	"	Pergande.
Anthomyiid puparia	"	Caudell.
Syllegoptera	"	Riley.

In the discussion Mr. Ashmead stated also that the question of priority was of course settled if Newport published his description in the Gardeners' Chronicle before Westwood.

There followed a paper, read by Mr. Howard, recording the conjoint observations of Messrs. Howard, Chittenden and Marlatt. The communication in substance was as follows:

UNMOTHERLY APHIDS.

On October 26th the members mentioned noticed the oviparous females of *Siphonophora tiliæ* descending the trunk of a large Tulip tree in the grounds of the Department of Agriculture in considerable numbers. High up on the trunk of the tree a cast skin of *Cicada pruinosa* was noticed upon which the plant-lice were observed to be crawling in considerable numbers. Upon removing the pupa-skin from the tree it was found to be stocked with the eggs of the *Siphonophora*. The legs were fairly lined with rows of the eggs. The conclusion drawn was that through the faulty instinct of the mother Aphids these eggs, or at least the young hatching from them, would probably perish through the pupa-shell being dislodged during the winter.

In the discussion of this paper Mr. Schwarz said that he dissented entirely from the conclusions arrived at by the authors of the paper, and remarked that it is a well known fact that by far the largest portion of the winter eggs of Aphids laid on the trunks or branches of trees are washed off and destroyed during winter and early spring by the rains or water from melting snow running down the bark. It appeared to him that the eggs laid on the dry pupa-skin of Cicadas are protected from these accidents, and since the Cicada skins so far as they do not drop soon after the hatching of the Cicadas usually remain attached to a tree for a year or longer, it would seem that these Aphid eggs had a greater chance to survive than those laid on the bark.

Mr. Banks read the following paper:

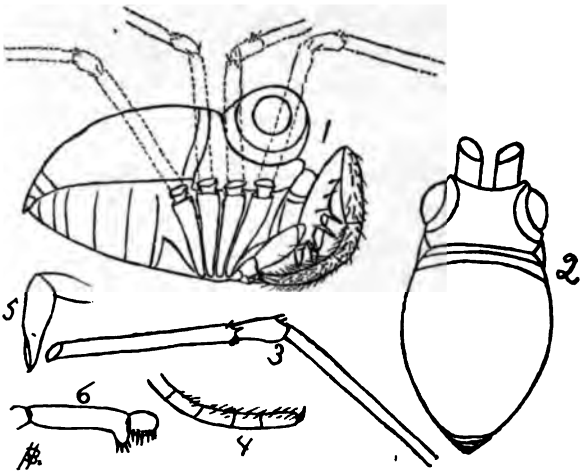
A NEW GENUS OF PHALANGIIDÆ.

By Nathan Banks.

While collecting in some woods near the seashore on Long Island, N. Y., in July, 1890, I found under several rotten logs a very curious Phalangid. It was exceedingly difficult to capture, as it ran with amazing swiftness when the log was overturned. I succeeded in capturing several specimens; in nearly all cases, however, the legs dropped off.

The principal peculiarity of the animal is the enormous size of the eyes and eye-tubercle. I know of no genus of *Phalangidia* that has such large eyes. It is a true Phalangid, and be-

longs to the sub-family Phalangiidæ. The principal characters may be seen in the following description of the genus and species:



Caddo agilis.—1, side view; 2, dorsal view; 3, part of leg; 4, end of tarsus; 5, mandible; 6, part of palpus.

*Caddo** nov. gen.

One claw to each tarsus; palpal claw present; fifth joint of palpi longer than the fourth; three large spines on lower part of the second joint; front margin of cephalothorax without spines; ocular tubercle covering the greater part of cephalothorax, wider than long, smooth, with a broad median furrow; eyes very large at each side of ocular tubercle; body soft and smooth, no apparent segmentation to dorsum of abdomen except at tip; feet slender; venter apparently of seven segments.

Caddo agilis nov. sp.

Length, 1.3 mm.; width of abdomen, 9 mm.; width of ocelliferous tubercle, 75 mm.; color, light brownish, lighter beneath, ocelliferous tubercle yellowish, eyes surrounded by black rings, palpi pale testaceous, coxæ yellowish, legs brown, lighter toward the tips; abdomen purplish brown, with small, lighter patches.

Palpi with many stiff bristles on joints 3, 4, and 5; a few on joints 1 and 2; tip of joint 2 with a projection internally, at the end of which are several stiff bristles; several bristles at tip of femora and two near tip of patellæ; tarsi hairy, one transverse suture near base of abdomen, three near the tip of abdomen, tarsi 18-jointed, basal joints longest.

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*An ancient Indian Tribe.

Dr. Gill, referring to the fact that Mr. Banks had taken an ancient Indian tribal name for his new genus, urged the advisability of employing names, where possible, referable to, or descriptive of, some peculiarity of the animal, rather than Indian or other irrelevant terms, or manufactured, or as they are commonly called, "nonsense" names.

Dr. Stiles urged that the rules recently promulgated by the International Congress of Zoologists at Paris be adhered to, and stated that the general zoologist has rights in the laws of nomenclature above the specialist, and the latter should yield to the former and adopt for his special and limited branch the general rules deemed best for the entire zoological or biological field.

Dr. Fox said that the code would not hold with the ornithologists of Great Britain and the United States, who have their own rules, in which the name of a species served the purpose of a mere number and need necessarily have no significance, either as to origin or meaning. The subject was discussed further at considerable length by the persons already mentioned and others, and finally, on motion of Dr. Stiles, a committee was appointed to bring up for future discussion and action by the Society the code of rules adopted by the Paris Congress.

Dr. Marx presented some remarks on the geographical distribution of spiders, in which he said that the Drassidæ, formerly supposed to be boreal in habitat are now found to occur in the tropics in abundance, and that as a matter of fact we have not a single family that is exclusively northern in range. In the Attidæ, however, certain genera may prove to be altogether boreal, but the family is not sufficiently worked up to admit a positive statement in this regard.

DECEMBER 3RD, 1891.

President Marx in the chair. Sixteen members present.

Under the head of short notes Mr. Howard said that Mr. Lugger, on page 61 of Volume I of the Proceedings of this Society, records *Mantis* (*Stagmomantis*) *carolina* as found on Smithsonian grounds November 11, 1886, and stated that as

furnishing a still later date he wished to record having found a vigorous female on the window-sill of his house November 16, 1891.

Dr. Marx presented the following paper:

CONTRIBUTIONS TO THE KNOWLEDGE OF THE LIFE HISTORY OF ARACHNIDA.

By Geo. Marx.

Thelyphonus giganteus Lucas.—The study of the life-history of some Arthropods is in many cases met with difficulties, and even made impossible by the habits of these animals. Some spend their lives buried in the solid wood of big live trees or in great depths of the earth, or in the water; others again are nocturnal in their habits, and of others we know nothing at all of their mode of living.

This is a great detriment to the general knowledge of natural science, not only that we lose the interesting and important features of the habits of the animal in question, but often the true character or the functions of organs, appendages and parts of the body are not at all understood, because their use has never been determined nor their applicaton observed. Take for instances the large and conspicuous comb-like appendages at the underside of the abdomen of the Scorpion; nobody knows with any degree of certainty the purpose which this serves; we infer by their proximity to the genital organs that they are probably accessories in the act of copulation, but this is a mere supposition.

Another instance in which external appendages are not at all understood, are the five peculiar lamellæ in the posterior coxæ and trochanteri in the Galeodes; here also, we stand before a conundrum which science has yet unsolved.

Many such instances may be cited in all orders of Arthropods, but accident often throws a spark of light into this obscure region and, if only these even, the most insignificantly appearing accidental observations, were duly recorded and put together we should be much better acquainted with the biology of some of our species. In the following I will record an instance in the life-history of one of our indigenous Pedipalpes, the *Thelyphonus giganteus* Lucas. Although my observations are insignificant in themselves, they may form, however, a small building stone for the structure of the natural history of this interesting Arachnid. On the 3rd of October, 1890, I received through the kindness of Mr. Howard two live young specimens of the species *Thelyphonus giganteus* which arrived the day previous in company with the mature female from Florida.

They must have been very young, perhaps only a few days old, as they measured from the front of the cephalothorax to the end of the abdomen 8 mm.

I prepared a home for them in a glass jar with a wide mouth, filled to a depth of about three inches with moist white sand; I constructed a little retreat of broken cork chips on the surface and caught a few flies.

The next morning the pair of *Thelyphonus* had built small subterraneous passages in the sand and apparently preferred these abodes to the cork retreats. The flies were untouched. About a week later I found one of them dead, whether it had died from starvation or lost its life in a fight with its sister, I cannot say. I changed the food and fortunately selected young Cockroaches, of which the Department Building furnished ample supply. These were relished by the captive; water that I introduced into the jar in a minute porcelain dish remained untouched.

The color of the young was a whitish-pink, the nine dorsal schlerites of the abdomen yellowish olive-brown, the three posterior legs and the carapace a darker brown, but the first pair of legs, the palpi and the trophi, a brownish rose-color.

The bristled tail was white and a little more fleshy than in the adult state, and densely covered with rose-colored stout bristly hairs, which were about two and one-half times longer than the diameter of the tail itself; this pubescence was more dense towards the distal extremity, while at the basal part (about the twelve first joints) it was very sparse. The habits were very sluggish indeed, even remarkably so, for a slow moving indolent animal as the full-grown *Thelyphonus giganteus*. When I took it into my hand to examine it to see if it was yet alive and then threw it back upon the moist sand, it remained for days in the same position as it landed, provided a strong light did not strike it; gradually it moved into its recess, when the jar was put into the dark closet; it fed on one, seldom two, roaches per week, and consequently grew very little, and only measured, after a year of captivity and plentiful supply of food, eighteen millimetres from the anterior border of the cephalothorax to the base of the tail; it had grown only ten millimetres in one year.

In the night of September, 1891, or about one year after its birth, it molted its skin for the first time; it had now assumed a very piceous color in all its parts and it seemed to be more lively in its movements. The old coat I found pretty well intact, lying on the sand; the upper part of the cephalothorax was removed at its lateral borders all the way around; it could not be found, and it had in all probability been devoured by the animal itself. I kept it in a dark closet, and its lively

movements while in there, and its hiding in its gallery under the surface while exposed to the light, proved its nocturnal habits.

Up to January 1st it was moving nearly always upon the sandy surface, often seen standing upon its hind legs trying to reach the roach above it on the wall of the glass jar, but on the 4th day of January it had retired to a space which it had previously dug out about an inch under the surface where it intended to hibernate, for it had shut off the canals which communicated with the surface. The form of this subterranean retreat is worth a fuller description. The room itself in which it hibernates is about half an inch high, and forms quite a large, wide chamber. The entrance is a narrow canal leading gradually from the surface to the chamber; on the opposite side of the chamber a similar passage leads to the surface; the whole structure is close to the glass wall of the jar, and every movement is therefore visible to the outside. I thus noticed that the animal is not in a dormant state, during what I consider the hibernating period, but is standing on its legs quietly, in a corner of the chamber, and it remained in this position until about April 1st, when it opened communication with the outer world, and was ready to receive its food of roaches as before.

It is still alive, and I intend to keep it in this state as long as I can. Should anything new and interesting occur during the curriculum, I will duly record it to the Society.

Datames caspari. n. sp.—A young friend of mine whose father possesses silver mines in Villaldoma, Mexico, sent me in April a beautiful specimen of a Galeodes, belonging to the genus *Datames*, with a very interesting account of its life habits.

Although the order of Galeodes is well represented in North America, both in the United States and Mexico, there is absolutely nothing known about its life history. I quote my friend's statement literally: "I found it in an ant hole devouring ants by the wholesale; the movement of its jaws was a peculiar one, for they would move up and down, and would also open with regular jaw movements after securing an ant; the motion would be a sort of rubbing or grinding as if you should place your hands together in front of you and first move one away from you and then the other towards you. After grinding its food and taking the juice it would drop the remains and go in for more."

This is, so far, all that has been observed by my friend; it was known before that this insect was nocturnal, but it seems by this report, that it also seeks its food in daytime.

My friend sent the specimen in alcohol (in very good condition), and it is therefore impossible for me to continue observations upon this subject, but I hope, however, to receive some live ones for further study.

Mr. Mann considered it very doubtful if records based on captive specimens reared in confinement would hold in nature—the development would generally be more or less retarded in the case of the confined specimen.

Dr. Marx agreed to this, and stated in reply to a question by Mr. Test that the roaches fed to the *Thelyphonus* at the outset were young ones, larger roaches being given it as it increased in size. He judged that the *Thelyphonus* was now about one-fourth grown and that it would reach full development in another year—moulting probably once more. In reply to a question by Mr. Mann, Dr. Marx stated that Arachnids have no definite number of moultings, but that the skin is shed a variable number of times, and whenever the growth of the animal makes it necessary.

Mr. Ashmead said that he was familiar with this Arachnid in Florida, and stated that it burrows in sand.

Mr. Schwarz said that they occurred usually in nearly dry sand and always under the protection of logs, etc., and that they never, either by day or night, are seen away from their burrows.

Mr. Howard introduced the subject of the poisonous character of *Thelyphonus*, and stated that a case of fatal result from its bite was vouched for by a professional naturalist, Mr. Dunn, a man whose testimony should have weight. He said, however, that he and others had handled living specimens without injury.

Both Mr. Ashmead and Mr. Banks referred to the belief commonly held in Florida that this insect is extremely poisonous, the former stating, however, that he had handled them frequently without experiencing any ill effect, and that he believed them to be harmless.

Mr. Schwarz stated that they do not occur in south Florida, where they are replaced by a species of *Phrynus* (*Ph. marginemaculatus* C. Koch), a most agile animal, which it is almost impossible to capture on account of its ability to always keep

the stone or log under which it occurs between the collector and itself, no matter how quickly or often the protecting object is turned.

Dr. Marx stated that dissection failed to indicate any evidence of poison orifice or sac and that the odor of vinegar, so noticeable in the adult animal, was not present until after the first moult.

Mr. Marlatt stated in regard to food habits, that adult specimens sent to Prof. Riley from Florida fed voraciously on grasshoppers and that they had probably a wide range of food insects.

Mr. Schwarz said that dead beetles were frequent under logs with *Thelyphonus* in Florida.

Mr. Pergande presented the following communication:

PECULIAR HABIT OF AMMOPHILA GRYPHUS SM.

By Theo. Pergande.

A very interesting article in "Naturwissenschaftliche Rundschau," Vol. VI, 1891, pp. 549–50, by Prof. Roman Gutwinski, in Tarnopol, regarding preparations for oviposition by *Ammophila sabulosa*, reminds me of an accidental observation, made in September of last year. While rambling about through woods and fields surrounding the City of Washington, I happened to come to a quite bare and more or less gravelly slope. Being tired and worn out from the long walk, I stopped to rest myself for awhile, when suddenly my attention was attracted to the peculiar actions of a handsome female of *Ammophila gryphus*, flying persistently back and forth in front of me. Remaining motionless for some time, so as not to frighten the insect, it alighted in front of me on a bare spot, about a foot square, scarcely more than a step from where I stood. For about a minute or two it ran briskly about in every direction, the head close to the ground and the abdomen elevated, while its antennæ were in constant agitation, as if searching for something important, though nothing in any way striking to the eye could be seen on the bare sand which possibly could have attracted its attention. Suddenly it stopped at a certain spot, pressed the head close to the ground, and commenced beating the ground with its abdomen, producing at the same time an audible and quite sharp sound, similar to bss, bss, bss; tapping with each sound the earth with the abdomen. Having gone through this performance for some time it ran about for a short

ınce, returned again to the identical spot and went through same operation as before. After this was repeated three ›ur times it ran about again for a moment, and then flew y. In a very short time it returned, however, to the same e, ran about like before till it found the identical spot, and t through the same performance for several times like be- After it got through with these ceremonies it ran a t distance and picked up with its mandibles a small pebble, ied it to the mysterious spot and deposited it on top of it, sing it at the same time down as much as possible to insure emaining in position. Running then again a short distance cked up another pebble and placed it close to the first one; awhile a third was added. No more pebbles of the de- l size being near enough at hand it ran some distance far- , when it came across a pebble which appeared to suit its ›oses; took hold and lifted it, but, unfortunately, the shape ıis little stone was such that it slipped from its jaws. It l again and again for quite awhile to obtain a good hold, gh without success, when it left it in apparent disgust. ning about after this failure for some time in search for a suitable stone, but not finding what was wanted, she re- ed to its little monument of pebbles, commenced to re- ıge and to press them again down as much as possible. r being satisfied that everything was well done she flew y, not to return. I then removed the pebbles and exam- the surface, but found no trace that anything had been sited beneath them or that the sand had been disturbed.

11.—Larva of *Heterocampa sub-albicans*, with egg of *Ammophila*—nat. size (original).

atisfy myself, however, if anything might be hidden in the ı under the pebbles which might have attracted the atten-

tion of the wasp, I commenced to dig with my knife, and was rewarded by finding, at a depth of about three inches, a fully grown larva of *Heterocampa sub-albicans* Pack., as fresh and bright as if it had been placed there but a moment before, and attached to it, at about the middle of the body, glued on to it for a short distance, an elongated and slightly curved white egg, about 3.5 mm. in length, by about 1 mm. in diameter, which, there can be no doubt, had been deposited there by this wasp, after the caterpillar had been placed in position. The burrow was then filled up and the surface smoothed so nicely that it was impossible for human, and perhaps other eyes, to discover the whereabouts of the precious treasure. Why, however, the wasp should return, after having apparently finished its task; be able to find the place again, go through such strange actions, and place the pebbles on top of the burrow, is difficult to explain. It may be then that its motherly instinct and love for its offspring urged it to revisit the spot to satisfy itself that everything was secure against intruders, and, to make surety doubly sure, to place obstructions on top by which other insects might be detained from entering the ground at this particular spot.

Dr. Fox said that he had observed on one occasion the intermittent action of the female of this species in constructing its burrow in hard ground. The work would be prosecuted with energy for a few minutes and then abandoned, to be taken up again after a short interval.

Mr. Ashmead said that he had had a similar experience in Florida, but had not seen anything corresponding to the piling up of pebbles described by Mr. Pergande.

Mr. Schwarz remarked that it would be interesting to know if this insect always takes the same kind of caterpillar with which to store its burrow.

Dr. Fox said, as opposing this view, that finding in adjacent cells of wasps totally distinct spiders was a common experience, and that in one instance (locality Massachusetts) one cell examined contained almost altogether specimens of *Lathrodectus mactans*, interesting as furnishing the most northern range of this spider, and the adjoining cell was filled with Thomisoid spiders.

Mr. Ashmead remarked that the wide distribution of the *Ammophila* in question renders a singleness of food-habit very improbable.

Mr. Marlatt mentioned the great abundance of this and other species of the genus in the treeless districts of western Kansas, and stated that they were to be found in immense numbers about the chalk cliffs on the cretaceous belt of the States, particularly on and flying over the hard-packed ground in the vicinity of the cliffs. The absence of trees would prevent their living on the larva mentioned by Mr. Pergande.

Mr. Banks presented the following paper

ON PRODIDOMUS RUFUS HENTZ.

By Nathan Banks.

Prodidomus rufus was described by Hentz in Bost. Soc. Nat. Hist., in 1850. He formed the genus for this peculiar species. Nothing has been heard of it since. In 1864 Simon described the genus *Miltia* and in 1884 he discovered that it was synonymous with *Prodidomus*. Simon placed it in the family *Enyoidæ*. Thorell, however, in 1875, made a new family for it, placing the family between the *Enyoidæ* and *Uroeteidæ*. In 1884 Simon placed it as a group of the *Drassidæ*; two other genera have been described which are related to it, viz., *Timiris* and *Trochanteria*. Six other species of *Prodidomus* are known from North Africa, Western and Southern Asia. Two species of *Timiris* are described from Asia. One species of *Trochanteria* from West Indies. The characters of the group *Prodidominæ*

Fig. 12.—*Prodidomus rufus*: 1. front view of head and mandibles; 2. tarsus; 3. lip and maxillæ; 4. inferior spinneret.

have been given as follows: Lower spinnerets biarticulate, mandibles very long, maxillæ attenuated and converging, trochanter four longer than usual. Hentz gave as the characters of the genus the following: "Eyes eight, placed near together, four in front making a straight row, two on each side forming

a curve with the external ones of the first row and leaving a space above; external ones sub-oval, two middle ones round and black, maxillæ triangular, wide at base, pointed at tip; cheliceres very large, fangs long and bent; feet 4, 1, 2, 3." Of the species he said: "Rufous; abdomen deeper above, venter pale, four nipples; feet 4, 1, 2, 3. Alabama, in dark cellars." Although the sub-genus, as he called it, is placed between *Cyllopodia* [*Hyptiotes*] and *Epeira*, he states under the head of "Observations" that this new sub-genus shows some of the characters of *Clubiona* and of *Theridion*."

Last summer I obtained some immature specimens of this spider. I first noticed one walking slowly over a shelf in a dark corner of the room. Specimens were afterward found between sheets of paper in a drawer, the latter had somewhat of a tubular web or mesh of threads. On examining the specimens one sees various peculiar structures, most, however, of but little importance. The color of none of my specimens is as red as Hentz describes; the abdomen is yellowish with some faint scattered silvery patches.

The cephalothorax and mandibles are yellow, the A. M. E. are black, and the fang of the mandible is red. The abdomen is covered with short hairs. The legs are whitish. There are five peculiar points to notice: 1st—The eyes; these are eight, four in a nearly straight line in front, the M. E. largest; behind the A. S. E., on each side, are two other eyes, the anterior one elliptical, the posterior one oval. The four front eyes are all round. On each side of the clypeal margin are four stiff bristles. 2d—The maxillæ; these are long and tapering, with the exterior border concave in the middle. 3d—The mandibles; these are very large, diverging, and furnished with a very long fang. 4th—The legs; these are furnished with four kinds of hairs; first, spines; second, bristles; third, short hairs; fourth, very long slender hairs; the latter I have never seen in any other spider. The claws are two and without teeth, but just under them is a very dense scopula. One will at once notice the length of the various joints of the legs. The trochanter is longer than usual, especially the hind pair. The patellæ are also longer than usual. The other joints are more nearly equal than in most spiders. The first pair of legs is somewhat stouter than the other pairs. The anterior pair of coxæ is much longer than the other pairs. 5th—The spinnerets; the the upper and lower pairs are large, the lower short, truncated, with long tubes. The lip is short, the sternum quite broad. As to its position, Simon has placed the group in the Drassidæ, and I think rightly; but there are many important features which ally it to the Dysderidæ, particularly the shape of the maxillæ, the size of the mandibles, the length of the anterior

coxæ, and the size of the anterior legs. Altogether I think that it represents a group in many points intermediate between the two families.

Dr. Fox thought that Mr. Banks placed too much stress on the importance of the long hairs occurring on the legs, and stated that they were by no means confined to this species, but occurred also in Thomisidæ and Lycosidæ.

Dr. Gill asked if the functional importance of these hairs is known, to which Dr. Marx replied that by German writers they are considered to be organs of hearing, or of service in that regard, and referred to analogous growths of structures which in the lower animals take the place in a measure of the more complex organs of the higher animals.

Dr. Gill and others discussed the organs of hearing and sound in different animals, arriving at the conclusion that in low animal life, as insect and arachnid, the sense of hearing is analogous to but has a much more restricted range than in the case of higher animals.

Mr. Howard stated that the appearance of well-developed sound organs in many insects argues that the organs of hearing are also well developed.

Mr. Chittenden presented the following paper for publication:

NOTES ON THE FOOD HABITS OF SOME SPECIES OF CHRYSOMELIDÆ.

By Frank H. Chittenden.

The food habits of the adult beetles of the Chrysomelidæ are well known as compared with those of many other families of Coleoptera. This is due to various causes. Their attractive appearance, often bright colored and conspicuous, the fact of their being more than usually gregarious and numerous as a rule in individuals, and the further fact of their being diurnal, feeding externally and exposed on leaves and flowers, all contribute to this end. Then the omnivorous nature of so many species, that leads them in time of scarcity of their wild food plants to depredate on useful and familiar plants, has, more than anything else, conduced to an intimate knowledge of their food habits. Thus they are constantly intruding on the notice of the agriculturist, the official entomologist and the student of nature, and as a result a very large proportion of the best known species have at some time been reported as injurious to

cultivated crops. The larval habits of the family are not so fully understood, still it is fairly certain that the larvæ are more restricted as to food plants than the adults.

Considered with regard to their habits of feeding, the larvæ may be roughly divided into three groups, viz., external leaf-feeders, internal leaf-feeders called leaf-miners, and root-feeders. The larvæ of the last group, including among others a considerable proportion of the *Eumolpini*, are, from their subterranean nature, less known than the others. A few forms do not fall within these groups, *e. g.*, the genus *Donacia*, which lives in the larva state in the stems of aquatic plants.

In the preparation of this paper from my original notes—collecting notes for the most part—I have omitted mention of all doubtful cases, and although the species mentioned herein have not in every instance been observed actually feeding on the plants on which they were found, their occurrence was in such numbers and under such circumstances as to leave little room for doubt as to their habits. Therefore, I feel confident that all plants mentioned in this article are *bona fide* food plants, at least of the adult beetles, of the species occurring upon them.

The observations which follow, where not otherwise specified, were made in central New York on the dates recorded.

Orsodachna atra Ahr., although well known as infesting willow, has not been included in the list of willow insects in Packard's Report on Forest and Shade Insects, and so far as I can learn no record of its food habits has ever been published.* It is one of our earliest insects in the Northern States, occurring in April, when the willow is in bloom. I have not taken specimens later than May. When variations in color, size and form are all taken into consideration this is certainly one of the most variable species of all our native Coleoptera. It is, moreover, a singular fact that such remarkable variations as are manifested in this one species are not due to climatic or similar conditions since all, or nearly all forms may be taken upon a single tree, and in all probability all may occur in a single brood. In material that I have had an opportunity to examine no new forms appear, whether from the South or from the Atlantic or Pacific States.

Anomœa laticlavia Forst. I have found this species swarming on two species of bush-clover (*Lespedeza* spp.) after the manner of the familiar *Chrysochus auratus* on the dog-bane. They were devouring the leaves, many specimens being *in coitu*. I have also observed these beetles eating the leaves of

*Since the above notes were presented for publication Miss M. E. Murtfeldt has recorded the occurrence of this insect in Missouri on peach, the blossoms of which it was injuring. (Bull. No. 26, Division of Entomology, U. S. Department of Agriculture, p. 38).

our common locust tree, *Robinia pseudacacia*, but never in numbers, although observed at intervals during several years' collecting. These beetles may also be taken sparingly on several other plants, but in most cases their presence is directly traceable to locust trees in the vicinity. I have never been able to detect the larvæ though frequent search has been made. Our knowledge of the food habits of the adults indicates the Leguminosæ as the favorite food plants of the species. It was most abundant at Ithaca during the latter half of July, although not uncommon both earlier and later.

The following references have been made to this insect: In the Annual Report of the Entomologist of the U. S. Department of Agriculture for 1887 *A. laticlavia* is mentioned by Mr. Herbert Osborn as having been observed in injurious numbers stripping the leaves of the honey-locust. It is included in a list of insects affecting cotton, published in the Catalogue of the New Orleans Exhibit of the U. S. Department of Agriculture; a simple notice of capture on willow is given by Mr. W. H. Harrington in the *Canadian Entomologist*, Vol. XVI, p. 101, and Mr. E. A. Schwarz has recorded it as occurring on oaks in Florida. I am satisfied that it does not attack oak in the North, at least not while there is an abundance of leguminous leaves available for food.

Bassareus detritus Oliv., was found on the leaves of the oak and of the New Jersey tea plant (*Ceanothus americanus*) from May to July.

Cryptocephalus venustus Fab. Of this species a specimen of the variety *simplex* Hald. was observed on the great rag-weed, *Ambrosia trifida*, dodging around the stem after the manner of a squirrel or lizard on a tree-trunk. This habit is common in *Proconia* and other genera of the Homoptera and in *Lixus* and *Languria* of the Coleoptera, but I have never noticed it in other Chrysomelids. The insect is a polyphagous leaf-eater.

Triachus atomus Suff., was rather common one year on the coast of Rockaway Beach, L. I., in July, on the wax myrtle or bayberry (*Myrica cerifera*). An indeterminate species of *Pachybrachys*, near *cœlatus* Lec., was found the same season upon this plant at Highland Beach, near Navesink, N. J. The latter was extremely abundant, occurring by the thousand in the latter part of June.

Cerotoma caminea Fab., has similar habits, as regards food plants, to *Anomœa laticlavia*, both species having been found on the same individual plants of bush-clover, *Lespedeza* spp., the former in less abundance, however, in most instances being found to attack the unexpanded leaf-buds or freshly expanded leaves. I have also observed this insect near Washington, in

May and June, eating the fresh young leaves of another leguminous plant, the hog pea-nut (*Amphicarpæa monoica*). Although occasional stragglers are found on other wild plants, this species appears to be somewhat restricted to the Leguminosæ. It occurs at about the same time as *Anomœa laticlavia*.

The only published records that I have been able to find of this beetle are those of Mr. F. M. Webster, in the Report of the U. S. Department of Agriculture for 1887 (p. 152), who found it destructive to beans and cow-peas in Louisiana and to beans in Indiana, and of Mr. E. A. Popenoe, in the Second Annual Report of the Experiment Station of the Kansas State Agricultural College, for 1889, who found it injurious to the bean in Kansas, and from the nature of its known food plant, designated it by the name of bean leaf-beetle. It was first reported by him as occurring on the bean in the Transactions of the Kansas Academy of Science for 1876.

In finding the insect in such abundance on bush-clover I believe that we have discovered a natural and favorite food plant, as there is scarcely a doubt that the larvæ also subsist in some manner on this plant.

Luperus meraca Say. During one season I observed this species in great numbers at Ithaca, from the middle of June until later, eating the leaves of witch-hazel (*Hamamelis virginica*), which appears to be a natural food plant. In some places it had developed a most extraordinary taste for the petals of the wild rose, and as an instance of their abundance, I have recorded in my collecting notes, having taken upwards of a dozen specimens from a single blossom, and even detected them gnawing the buds. In other localities the roses were entirely free from attack. It ate also the leaves of blackberry, raspberry, chestnut and other plants. The occurrence of the insect in such numbers during this single year was exceptional as the beetle is comparatively rare, for a Chrysomelid, in most localities that I have visited.

Galeruca tuberculata Say, was found in numbers on low willows (*Salix* spp.) during the first part of July. In the larval state they doubtless live also on willow leaves, as I found at the same time with the imagos what I took to be the larvæ of this species. It might be worth recording that this species was only found in one year in a very restricted locality, and on a single clump of trees, not a single specimen being taken at any other time. From the close relationship of this insect to its congener, *G. decora* Say, it will probably be found to have nearly identical habits. The latter has been found a serious enemy to the leaves of willows by Professor Riley, who mentions it in his Annual Report for 1884.

Galeruca notata Fab., occurs in all stages on bone-set or thoroughwort, *Eupatorium perfoliatum*, during the latter part of August and the first part of September, when the plant is in bloom. When the larvæ are full-fed they ascend to the flower heads and drawing the flowers together by means of webs, form between them a cocoon of loose net-work in which the pupal stage is passed. The species was quite common at Cold Spring Harbor, L. I., during the season of 1890.

Disonycha pennsylvanica Ill., occurs in abundance in the neighborhood of New York in May on different varieties of the common aquatic arrow-head, *Sagittaria variabilis*. Several color variations occur together.

Disonycha triangularis Say. Of this species Miss Murtfeldt has already placed on record *Chenopodium* as the probable natural food plant. It is also recorded as injurious to beets and spinach. It has been found, in my experience, most numerous on *Chenopodium album* and in less numbers on *Amarantus spinosus*. My records of its occurrence in New York state range from the beginning of April to the end of October.

Haltica marevagans Horn is the common flea-beetle of the evening primrose (*Œnothera biennis*). Of the distribution of this species, Dr. Horn states that it occurs along the coast region from Florida to New Jersey, and probably farther north. He also says that in most of the collections examined by him it was labelled *foliacea*. The beetle occurs in the greatest abundance along the New Jersey coast and on the shores of Long Island in the neighborhood of New York City. On the north shore of Long Island at Cold Spring Harbor it also occurs, and I would not be surprised to know if its geographical range might be further extended to the southern shores of Long Island Sound in Connecticut, and perhaps even to Rhode Island and Massachusetts. Although the insect, together with its food plant, has been well known for years it was not described until 1889. I have noticed the beetle near New York from the first week of July until September, though no doubt it occurs there earlier and later, and in every place along the seashore where its food plant is to be found. On the coast of New Jersey, from Sea Girt to Long Branch, the evening primrose swarms with their numbers. They devour the leaves, all but annihilating them, and even nibble large holes in the seed pods. Like so many others of the *Halticini* they eat voraciously, and unless in the heat of the day are not particularly active, seldom flying, and jumping only from two to four inches. When rudely disturbed or shaken from their food plant they fall to the sand and there remain for some time, whether on their backs or otherwise; when in the former position they simulate death. As an instance of their abundance

I have recorded having counted upwards of thirty adults, besides numerous larvæ on a small plant of only a few inches in height. At the time of this observation, about 6 P. M., very few specimens were noticed *in coitu*, not more than one pair in a score Some plants were completely riddled with holes and undoubtedly died prematurely. They are usually accompanied by the Curculionid, *Cœliodes acephalus*.

Crepidodera rufipes Linn. The leaves of the common locust tree, *Robinia pseudacacia*, constitute, in my experience, the favorite food of the beetle from central New York south to Virginia. It is abundant throughout the month of May.

Systena hudsonias Forst., judging from its known food habits is entitled to rank with beneficial insects. It feeds as adult on field and garden weeds of many kinds, and no doubt assists materially in keeping them in check. As far as I can ascertain it has never been recorded as attacking cultivated plants. I have observed this beetle feeding freely on the following weeds: Smart-weed (*Polygonum hydropiper*), dock (*Rumex* spp.), daisy (*Chrysanthemum leucanthemum*), flea-bane (*Erigeron canadensis* and *philadelphicus*), plantain (*Plantago major* and *lanceolata*), ragweed (*Ambrosia artemisiæfolia* and *trifida*), golden rod (*Solidago* spp.), catnip (*Nepeta cataria*), *Brunella vulgaris*, and species of vervain (*Verbena* spp.). This list could doubtless, with a little further observation, be greatly extended. When found upon the smart-weed the little insects had riddled the leaves with holes. On dock they were also numerous. They choose by preference the tenderest leaves of young plants, those of only a few days' growth being frequently attacked, but they infest as well plants that are more mature. Their work varies much, according to the nature of the plant attacked, but in general they eat out little holes here and there after the manner of other flea-beetles. On warm days they are quite active and voracious. The beetles abound throughout the summer months and occur on a number of other weeds, particularly of the Compositæ, besides those mentioned. I have repeatedly found stragglers on growing corn, but could not discover that they had attacked the leaves. A natural food plant, one of the weeds above mentioned, was always sure to be found hard-by inhabited by a little colony of the beetles.

Systena frontalis Fab., occurs with *S. hudsonias* on the smart-weed also on pig weed (*Chenopodium album*) and other weeds, but in smaller numbers. August and September.

Odontota rubra Weber. The leaves of the basswood (*Tilia americana*) form the favorite food for this insect in central New York. Both larvæ and adults, the former mining the

leaves, the latter feeding on the under surface of the same, were abundant at Ithaca during the month of June. I have specimens of the imago taken as late as September.

Coptocycla purpurata Boh., has the same habits as its congeners *C. aurichalcia* and *C. guttata*, being found like them on Convolvulus, and in all probability on other plants of this family. I have never seen any record of this habit, doubtless owing to the fact that this species is so closely allied to the other species above mentioned as to have escaped the notice of most collectors who have classified it with one of the other two.

Mr. Schwarz called attention to a statement by Dr. M. Büsgen (in the latter's recent work on the honey-dew of Aphids) to the effect that the honey-dew is not secreted from the nectaries as hitherto supposed, but ejected from the anus. He also referred to an interesting work recently published by C. A. Piepers on the migratory movements of certain butterflies on the Island of Java and gave a brief resumé of the author's explanation of this phenomena, which is comparable to the nuptial flight observed in other insects.

Mr. Ashmead in referring to the paper on the secretions of honey-dew by Aphids, remarked that the conclusion of the author was certainly not true of all Aphids, as he knew from having himself noted, in the case of several species, the exudation of this liquor from the nectaries.

Statements to the same effect were also made by others.

Referring to the migrations of butterflies Dr. Marx related having been surrounded with scattering swarms of *Grapta interrogationis* on Lake Michigan for two days in succession and described the manner of flight of these insects, and mentioned that they were falling into the water. Mr. Howard said that they very probably came from the hop fields in Wisconsin.

A LIST OF SPIDERS FROM INDIANA.*

By Dr. Wm. H. Fox.

The list of spiders presented below is from a small collection of Mr. Frederick C. Test, sent me for identification.

My reason for presenting them to the Society is that they are from a locality that has never been collected in before, and one that is mentioned in Dr. Marx's Catalogue but three times.

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* This paper is referred to on p. 218, but was not received in time for insertion in its proper place.

Our knowledge of the distribution of spiders is almost nothing, so this paper is brought forward in the hope that other local lists may follow, and thus be the beginning of a more perfect knowledge of our fauna.

Localities given are from Dr. Marx's list:

Ariadne bicolor Hz. Eastern U. S., Mass. to Florida.
Drassus robustus Em. Mass.
Prosthesima depressa Em. Mass.
ecclesiastica Hz. U. S.
Dictyna arundinaceoides Keys. Col.
Amaurobius ferox Walck. Eastern U. S., from D. C. north; Cal., Dak., Mont.
Anyphæna rubra Em. New England, N. Y.
Clubiona rubra Keys. Atlantic States from N. C. north.
Trachelas ruber Keys. Atlantic States, Mass. to Ala.
Thargalia crocata Hz. Eastern U. S.
* *trilineata* Hz. Eastern U. S.
Agelena næria Walck. U. S.
Tegenaria derhami Scopoli. U. S.
Cicurina complicata Em. Mass.
Cœlotes calcaratus Keys. D. C., Colo., Wyo., Minn.
medicinalis Em. N. Y., Mass.
Theridium murarium Em. Eastern U. S. and Colo.
tepidariorum C. Koch. U. S.
Steatoda borealis Hz. U. S.
Teutana triangulosa Walck. Eastern U. S.
Lithyphantes marmoratus Hz. Eastern U. S. and Colo.
Lathrodectus mactans Fabr. U. S.
Asagena americana Em. Eastern States.
Ero furcata Villers. Europe, Mass., Conn.
Euryopis funebris Hz. Eastern States, Utah, N. Mex.
Linyphia bucculenta Clerk. Europe, Atlantic States from Va. northward to Mass.
mandibulata Em. Atlantic States from Va. northward and Lake Superior.
nigrina Westring. Atlantic States from Maryland northward, Tennessee.
Erigone inornata Em. Mass., Conn.
Acrosoma gracile Walck. Atlantic and Gulf States, except northern N. E.
sagittatum Walck Atlantic and Gulf States, except in northern N. E., Tenn.
Argiope argyraspis Walck. Atlantic States from N. C. northward, Cal., Ariz., Kans.
cophinaria Walck. Atlantic and Gulf States, Cal., N. Mex.
Ordgarius cornigerus Hz. Ala., D. C., Va., La.

* Marx Catalogue; not in collection.

Mahadeva verrucosa Hz. D. C., Va., Florida, Ala.
Epeira arabesca Walck. Atlantic and Gulf States, Utah, N. Mex., Cal.
benjamina Walck. U. S.
cornuta Clerk. Atlantic States, Minn., Ill., Wis.
displicata Hz. Atlantic and Gulf States, Col., Cal., Ohio.
eustala Walck. U. S.
globosa Keys. New England, D. C.
marmorea Clerk. U. S.
sclopetaria Clerk. U. S.
stellata Walck. Eastern States.
trifolium Hz. U. S.
Cyclosa turbinata Walck. Atlantic and Gulf States, Ohio
Argyrœpeira hortorum Hz. U. S.
Meta mendari Latr. Mass., Ky., Va., D. C.
Tetragnatha elongata Walck. U. S.
laboriosa. U. S., Alaska.
Pachygnatha tristriata C. Koch. D. C. Pa., N. Y.
Hyptiotes cavatus Hz. Atlantic States.
Lycosa carolinensis Walck. Atlantic and Gulf States.
communis Em. New England.
frondicola Em. Conn.
ocreata Hz. N. C., Ill., Conn., D. C., Va.
nidicola Em. Mass., R. I., Conn.
nigroventris Em. Mass.
polita Em. Mass., N. Y., Conn.
punctulata Hz. Atlantic and Gulf States.
tigrina McC. New England.
Pirata montana Em. N. Y., N. H.
minuta Em. Mass., Conn.
Trochosa avara Keys. "North America."
Pardosa nigropalpis Em. Mass., Conn.
Dolomedes sexpunctatus Hz. Atlantic States from N. C. northward.
tenebrosus Hz. Atlantic States.
Phidippus rufus Hz. U. S.
morsitans Walck. U. S.
Philæus militaris Hz. U. S.
Dendryphantes capitatus Hz. U. S.
elegans Hz. Atlantic States.
Icius mitratus Hz. Southern States, Pa., Wis.
Saitis pulex Hz. Eastern States.
Astia morosa Peck. Cal.
vittata Hz. U. S.
Epiblemum scenicum Clerk. U. S.
Marptusa familiaris Hz. U. S.
Phlegra leopardus (Hz.) Em. Mass., Ala., Ohio.

JANUARY 7, 1892.

The seventy-seventh regular meeting and the seventh annual meeting.

President Marx in the chair. Eighteen members and two visitors present.

The election of officers for 1892 resulted as follows: President, C. V. Riley; Vice-Presidents, C. L. Marlatt and W. H. Ashmead; Treasurer, E. A. Schwarz; Recording Secretary, Nathan Banks; Corresponding Secretary, L. O. Howard; Executive Committee, W. H. Fox, Geo. Marx, and B. E. Fernow.

The retiring President, Dr. Marx, delivered his Annual Address:

ANNUAL ADDRESS OF THE PRESIDENT.

ON THE MORPHOLOGY OF THE TICKS.

BY GEORGE MARX, M. D.

While studying the natural history of the *Cynorhæstea** which had come under my observation during the last few years, and searching the European and American literature for some points on the morphology of these interesting parasites, I noticed that the views of the various writers conflicted widely, and, judging from the unscientific and indefinite descriptions of the new species, I soon became convinced that our knowledge of the external anatomy of this group of Acari was by no means a perfect one.

The treatment of our indigenous species by American entomologists has hitherto been confined to the description of twenty-three new species.†

* See the author's article: Note on the Classification of the Ixodidæ, Proceed. Entomol. Society of Washington, Vol. II, No. 2, p. 232.

† *Say*, in 1821, describes eight species in Proceed. Ac. Nat. Sc., Philadelphia, Vol. II, p. 19.

Packard, 1869, published ten descriptions in First Annual Report Peabody Academy, p. 65;

Riley, in the same year, one species in Report of Commissioner of Agriculture on Diseases of Cattle, p. 118;

Fitch, in 1870, four species in the 14th Rep. of the New York State Agricl. Society.

This large number itself proves a lack of knowledge of the morphology of these animals, for in the limited area in which they were observed there are, according to my judgment, not more than six or eight species. The descriptions of this small number of species by one author were so defective that his successors were unable to recognize them and redescribed them as new ones, for these descriptions are based on such points as the form and size of the body, rotundity or flatness, the color and the markings of the abdomen, etc., points which depend on the stage of development or the condition of the life habits—parasitic or free-living.

In only one instance I found a short treatment of the Ticks in a more general way by an American naturalist, and this contained gross misstatements and inexcusable errors, so that I must not only consider it as worthless, but as absolutely misleading to the student.

This is the more remarkable since long ago some of the European arachnologists expressed their views in a generally correct way, only deviating in details.

Thus *Carl L. Koch*, the father of arachnology, nearly fifty years ago issued in a concise form a treatise on the Ixodidæ in which he explains the main features of the morphology and gives a standard classification of this group, while ***Pagenstecher***, about thirty years ago, published a very valuable work on the internal and external anatomy of Ixodes.

It is therefore inexcusable to find in a standard hand-book, re-issued in the eighth edition in 1883, such statements as the following: "the maxillæ of the Ixodidæ are three or four jointed" or "the thorax is very distinct from the head and the abdomen" or "the males are distinguished from the females by their larger cheliceres (maxillary palpi) and larger pair of clasping legs" or "the legs in the young with a distinct membraneous foot pad."

But as a kind of consolation I can quote also similar stupendous errors from the publications of some European naturalists, as the following: *Kolenati* informs us that the Ticks have four eyes, two on the upper side and two on the under side. ***Prof. McAlister***, of Ireland, discovered two peculiar glandular sacks, opening on the sides of a Tick, and considered this discovery of sufficient importance to base a new genus upon it, but by the description and

illustration it becomes clear that the author has observed the large stigmal plate, which every mature Tick possesses. *Mr. Murray*, of England, the author of a series of hand-books on natural history, discovered among the collection in the South Kensington Museum a genus which he named *Xyphiastor*, and bases the criterium on the following characteristics: "Flat, mouth provided with a long, projecting rostrum and long palpi applied to it, abdomen with posterior margin beaded." The same author bases a new genus solely on the fact that its members live or have been found on serpents.

After these few preliminary remarks on the present state of our knowledge of this interesting group, I proceed now to the subject of my address.

In the *Cynorhæstea*, as in other suborders and families of the great order *Acari*, the cephalothorax is coalesced with the abdomen into one solitary body, and the traces which seem to indicate the original divisions are so obscure that it is difficult to decide whether, in following them, we explain correctly the true organization. These traces are, First,—a shield on the dorsal surface, which in the Antistomata is present in both of the immature stages of the two sexes and also in the fully developed female, while it is absent in the mature male. This shield occupies in the young larva, and in the nymph in the free state, nearly one-half of the abdominal region, and as it does not grow with the rest of the body it is in the full-fed stage of the nymph, and especially in the full grown female, of comparatively small size. That it is rather a cephalic than a thoracic shield, as Packard states, I infer from the fact that it bears on its sides the eyes, if such be present.

Second,—The orifice of the oviduct in the mature female and that of the sexual organs of the male are situated very close to the insertion of the capitulum, and, as these organs are always placed on the abdomen, I infer that the abdomen reaches close to the anterior border of the body. If this be true, the distinct and impressed line which runs in both sexes in front of these orifices, and backward and outward on both sides, would be the trace of the border between the cephalothorax and the abdomen. In other words, the abdomen would be wedged into the middle region of the cephalothorax, and this part would surround

the lateral sides of the abdomen, leaving it free only at its posterior region.

Third,—The posterior border of the abdomen is divided by eleven lines into thirteen small lobes, probably the remains of an articulation in the primitive type; which theory is strengthened by the fact that we find several transversely curved lines running over the posterior abdominal region, one generally from the second lobular division line of the posterior margin, around the anus and to the corresponding place on the other side; another, probably a double one, from the anus backward to the impar (middle) lobe.

Although the cephalothorax is blended with the abdomen into one solid body, the mouth parts are free and form a little head-like structure in front of the body. This part, which was considered the head by the older writers, and even by some of the present day, as *Kolenati* and *Packard*, and which I will call *capitulum*, in conformity with Haller's nomenclature of the same part in the Gamasidæ and other allied families, is inserted into the front of the body in different ways, which give cause for the division of this sub-order into three divisions. The first differentiation is the place in which the capitulum is inserted into the body: for while in some genera the capitulum is invisible from the dorsal view because it is inserted below the projecting upper surface, in others it is inserted on the same level with the dorsal surface. The first section I call Catastomata, and the second Antistomata. But in the Antistomata we notice two different ways of insertion; in one, the front margin of the body, the clypeus, is excavated, and in this concave region the capitulum is situated—this is the great group of the Ticks proper; in a small number of genera the clypeus is not excavate and the capitulum stands squarely against it.

In treating, in this paper, only of Ticks, I would be understood to mean only those Cynorhæstea in which the capitulum is sunk in the excavation of the clypeus—the Antistomata.

The capitulum or pseudo-head of all Cynorhæstea consists of three principal parts: *the basal piece*, *the rostrum*, and *the palpi*.

The basal piece or *capitulum proper* is a broad, thick, subtriangular, ring-like organ, with a somewhat flattened upper and

lower surface. It is covered by a very thick chitinous integument and is connected at its posterior border with the body by a broad and short muscular band, the pedicel, by which it is enabled to move on this axis only upward and downward. Its superior surface presents a subtriangular form, as the centre of the anterior border is drawn out into a sheath-like prolongation in which the basal parts of the mandibles are concealed.

The lateral sides are either straight or drawn out into a more or less prominent point, as in *Boophilus* and *Rhipicephalus*. The posterior border is generally straight or slightly emarginate, and often strengthened by an elevated chitinous ridge, while the posterior lateral corners are frequently drawn out into a more or less prominent spine-like process. Upon the dorsal surface we notice, especially distinct in the female, two small circular and impressed spots side by side which are generally of a lighter color and coarsely punctured. These have been by some writers (Kolenati) considered as the eyes.

At the underside the basal piece is generally a little longer than at the dorsal side, and we notice here a transverse line dividing the surface into halves.

The morphological character of this basal piece has, by various writers, been differently explained. I hold, however, with Koch and Pagenstecher that this organ is formed by the coalescence of the labrum above with the labium and mentum below. The larger size and the visible dividing line speak in favor of this view.

The *rostrum* or *proboscis* is of an elongate form and extends, in the young ticks, horizontally forward; in the mature stage, however, it projects downward at an angle. It consists of those organs which serve to pierce the skin of the host and to draw its blood. It is composed of the mandibles and the maxillæ in their peculiarly modified forms (suiting a life as a parasite), the former lying closely with their underside upon the upper surface of the latter, forming thus apparently one piece. The maxillæ at their upper or inner surface are excavated longitudinally, and as the underside of the mandibles is also concave to near the tip, a channel is thus established through which the blood passes into the stomach. This fact, although easily made visible by cross-sections, has never been observed before, and is emphatically denied by Pagenstecher.

The mandibles are here modified into two long cylindrical bodies, placed side by side. They are enclosed for a part of their length in scabbard-like prolongations of the labrum or basal piece, in which they slide forward and backward and which protects them and gives them the strength necessary to pierce the tough epidermis of the host. These protecting sheaths are of a strong chitinous consistence and their surface is roughened like a file.

The mandibles are two-jointed; the basal joint is much longer than the apical one, of a rod-like form and chitinous structure, and reaches down or back into the front part of the body, where it is connected with a set of muscles by which these organs can be moved fore and backward. The superior surface of this joint consists of a hard chitinous tegument which turns downward at the lateral edge and leaves a free, concave space in the centre of the inferior surface, which serves at the upper portion of the abovementioned channel.

The body of the first mandibular joint is filled out by the muscles which serve in the movements of the second joint; they are visible at the underside in the free space between the two upturned edges of the chitinous tegument of the upper surface, which space is covered by a transparent membrane.

The second mandibular joint is of a very complicated structure. It is much shorter, transparent, of a glass-like, hard consistence, and movable sideways (externally) from the tip of the basal joint. It is composed of two closely approximated parts, which are somewhat blended together, the inner one being longer than the outer one. Their external edge forms a series of strong, large teeth, each of which is provided with a minute channel which terminates in an orifice near the tip. There are generally four of these teeth, two belonging to each part, but sometimes there are five or six. The fifth or sixth are, however, much smaller than the others. Some of these teeth appear to have a funnel-shaped base, which probably can be pressed against the wall of the wound inflicted by the whole apparatus, where it may serve as a vacuum, thus facilitating the flow of the blood. A membraneous, hyaline sheath surrounds the base of this second mandibular joint and has a part of the edge fringed out into the fine, needle-like projections.

The maxillæ have, on account of their peculiarly modified form, been variously understood by naturalists, and some of the writers have considered them as an organ related to the lips or the tongue (ligula, glossoide, languette, etc.).

The reason for considering this organ homologous with the maxillæ of the Arachnida is that these organs appear in pairs, and generally at the underside of the mandibles, which is exactly the case here. The only instance where a ligula is present in the Arachnida is in the higher Pedipalpi, the Amblypygi, where this organ can be recognized by the pair of paraglossæ inserted into its apex, as is the case with Insecta. Koch and Pagenstecher have also considered the lower part of the rostrum as maxillæ.

The maxillæ appear here as one elongate, flat, and more or less clavate piece, with a distinct middle line, indicating that it is composed of two halves. They are generally about as long as the mandibles when retracted; sometimes a little longer, other times slightly shorter; their internal or upper surface is longitudinally excavated, thus forming the under half of the channel with which the rostrum is provided. The free underside is covered at the tip with radiating minute scales which give this part the appearance of a rasp. Further down these scales assume a larger size and form large lozenge-shaped plates with their lower parts drawn out into a tooth. This armature is strongest and most prominent at the borders of the maxillæ, where these teeth appear as large hooks bent outward and backward. The arrangement of this armature, the number of the plates, their form and the area which they cover on the surface of the maxillæ differ not only in the sexes, but also in the genera and species, and furnish very important criteria for classification.

The palpi are situated on the anterior lateral angle of the basal piece, on each side of and close to the rostrum; they stand somewhat sideways to the dorsal surface of the rest of the body and are in most genera of the Antistomata about as long as the rostrum. They have four joints, although some of the older writers could only discover three joints. The palpi present in the different genera a great variety of form and structure. In the family Ixodidæ they are long and cylindrical, while in the Rhipistomidæ they are nearly as long as broad and more of a triangular shape. These differentiations are made use of in the characterizations of the genera.

The basal joint is distinct, though small, ring-like, and shorter than broad. It is by its free situation on a sloping base that the palpi are enabled to move in a perfectly horizontal position, when the rostrum is introduced to its full length into the skin of the host. The second joint is often blended together with the third into one large part, but a dividing line is always visible. The second joint has its upper side at the base sometimes drawn out into an angle which reaches over the first joint and gives it a somewhat triangular aspect. In another instance this joint is at its base drawn out latterly into a sharp and prominent point (*Rhipistoma*). Sometimes this projection at the base is rounded (*Hæmaphysalis*), or the second and third joints have each at their base a prominent rim which reaches externally over the edge of the joint (*Boophilus*). The third joint is generally shorter than the second, but sometimes a little broader (*Amblyomma*), giving the palpus a clavate appearance. In some instances, however, it is narrower. The second and third joints are always excavated or canaliculated longitudinally at their inner side so that the palpi can enclose the sides of the rostrum and form a projecting sheath for that organ. The fourth joint is a very peculiar one in regard to its form and position and was for a long time misunderstood. Koch says that the three-jointed palpi have on the last joint an orifice which is closed by a membrane, that serves as an olfactory organ. He had, however, doubtless examined only dead specimens, for here the fourth joint is retracted in the body of the third, and what Koch considered a membrane is in reality the apex of the fourth joint. This terminal joint is not visible from the dorsal view, for it is inserted on the underside and at the inner edge of the third articulation; it is very small and more slender than any of the other joints and can not only be projected and retracted, but moved at will in all directions with astonishing rapidity against the slightly projecting outer edge of the base, like a thumb against the hand.

The Body: In describing the morphological features of the body I deem it necessary to consider this part separately in the two conditions of the Tick, the free-living and the parasitic states. The former will be considered first and the three stages of development treated separately.

The young, newly-hatched Tick presents in its ***first*** or ***larval***

state a flat, nearly circular form and is in many parts, as the legs, the capitulum with the appendages, and in some parts of the body, semi-transparent. The specific characteristics of this stage are, first, the presence of only six legs, the fourth (posterior) pair being absent; second, the absence of the generative system and, externally, the orifices of the sexual organs; third, the absence of the respiratory organs, and here this first stage of a higher developed form shows a peculiar relationship with the inferior group of Acari—the Atracheata. The six legs are comparatively long and the joints thicker and swollen. The empty stomach can be recognized through the hyaline integument as a white, somewhat cloudy spot, while the cæcal intestines often show traces of black fæcal matter, and thus give to the body a figured aspect. The anterior part of the dorsal surface is covered more or less widely by a somewhat darker colored shield which is generally very conspicuous and varies in the different species but very little in length and width; when the eyes are present in the adult stage, they are indicated by darker spots. The mouth-parts are imperfect, the plates and hooks of the maxillæ and the tip of the mandibles rudimentary or only indicated, but the epidermis is already provided for an abnormal extension in case the animal is so fortunate as to find a vertebrate host to fill itself with its blood. This possibility of an immense extension is due to a peculiar condition of the integument, which consists of numberless minute corrugations or wrinkles. These folds may be smoothened out by a pressure from within and afford thus a greater capacity of expansion, which is necessary in a parasitic state of life.

Three very small orifices may be observed: the first, close to the margin, between the first and second coxæ and the last; the next, between the second and third coxæ, and the last, behind the third coxæ, the two latter somewhat removed from the margin of the body at the underside. Although these openings resemble stigmata, I have been unable to observe any traces of tracheæ attached to them, and I presume that they may be openings of some glands (coxal glands?).

After the first moult the Tick enters into the *second* or *nymphal stage*, which is characterized, first, by the presence of the fourth pair of legs. The process of this development has been going on

during the larval stage and can be sometimes observed by a low power of the microscope by transmitted light. Second, the now fully developed respiratory system, externally the large saucer-shaped stigmal plate behind and a little above the posterior pair of legs, and the internal tracheal system; third, the absence of the genital orifices. The Ticks in this stage are still sexless. No external character points to the future sex, and all nymphs, whether they will hence be males or females, look alike, having a dorsal shield. The body has become more firm than in the larva, the mouth-parts and the legs have lost their hyaline aspect, the chitinous sclerites which cover these parts have stronger development, the legs are now more slender and more cylindrical, and the palpi and rostrum are darker in color, but are still smaller than in the adult stage. The dorsal shield has not developed to a larger size, and as the body has grown considerably the shield appears proportionally much smaller than in the larval stage.

When the Tick has moulted the second time, it passes into the *mature stage*. Here the sexes are differentiated by prominent morphological characters.

The body of the mature Tick, male and female, in the free-living state, is considerably flattened dorsally and somewhat less so on the underside; it is of an oval shape with slight variations in some genera.

In *Ixodes* it is somewhat constricted in the stigmal region, giving the body a violin-shaped appearance; in other instances the one end of the body is more or less attenuated; in ***Boophilus*** it is the posterior part, in ***Dermacentor*** the anterior one; while in *Amblyomma* the body is more circular than oval.

In the majority of genera of the Antistomata--the families Ixodidæ and Rhipistomidæ—the rounded anterior border of the body is deeply excavated or squarely cut out, causing on each lateral margin a sharp projection which affords protection to the capitulum, inserted into the excavation. In the family Hæmalastoridæ, however, this excavation is wanting and the capitulum is here connected with the body by a free pedicel, but, as I have been unable to study specimens of this family, I cannot verify these statements.

The body of the Tick is covered by a leathery integument, which

assumes generally on the dorsal surface a hardened, chitinous, more or less smooth and darker appearance. Near the margin of the lateral and posterior sides the dorsum is impressed by a deep line, leaving a distinct rim around the whole body. This rim is in its posterior region divided, by eleven lines, into thirteen distinct lobes.

But we notice in the females of two genera a striking deviation from this character, for here, in *Ixodes* and *Boophilus*, the integument of the dorsal surface is not more hardened, chitinous, or darker than on the underside. The lateral rim and posterior lobes are absent or only faintly indicated, and the whole body is covered uniformly by more membraneous, coriaceous tegument, in consequence of which the sides are more rounded and the body more cylindrical than in the other genera.

The body of the adult female is differentiated at once from the male by the prominent dorsal shield which we have observed in all the inferior forms and which is here retained only in the mature female, while it has disappeared as such in the male, where it, in fact, extends over the whole surface.

This dorsal shield surrounds more or less that excavation of the body in which the capitulum is inserted; its size, form, and structure vary in the different species, but it is generally of an ovate or lozenge-like form, longer than broad, and its anterior border is either not broader than the base of the excavation, or it is so broad that it covers the whole anterior part of the body to its external margin. The former is the case in *Ixodes*, while the latter occurs in *Amblyomma* and *Hyalomma*. In *Dermacentor* it extends to the two anterior sharp projections between which the capitulum lies, but here the shield does not reach the margin of the body. The shield in its extension backward becomes broader to about the middle of its length, whence it attenuates to the posterior end. The surface of the shield is marked with round pin-like, larger or smaller impressions, which are generally more frequent and of a larger size in the anterior region.

Two impressed lines, more or less distinct, starting from the lateral sides of the excavation and running backward in various shapes, divide the surface of the shield into three parts—the middle and two external wing-like portions. The median part is often considerably swollen or arched in its anterior area, while the

wings are always flat. The eyes, when present, are always placed on the side of these wings, and in the instance where the shield reaches the lateral margin of the body the eyes are found upon the edge of this margin.

The upper side of the female body is generally marked by two or three more or less distinct longitudinal impressed lines, which are due to the insertion of the internal system of the supero-inferior muscles on both the dorsal and ventral integument. They show even in the greatly distended body of the parasitic state as fine lines.

The dorsal surface, the shield as well as the abdomen, is in certain genera (*Amblyomma*, *Hyalomma*, *Dermacentor*, and *Hæmalastor?*) ornamented by silvery shining or dull, tallow-like colored figures which are of a constant character and therefore excellent criteria for the respective species. This is, however, only the case in the free-living state, as in the distended body of the parasite the markings of the abdomen disappear and only those of the shield remain.

The underside of the female body is generally less hard, more membraneous, and of a paler color. The peculiar impressed lines which divide the ventral surface I have spoken of above, and the orifices found here I will consider hereafter.

The mature male is easily recognized by its often considerably smaller size, the more elongated form of the body, and the extension of the shield over the whole surface. The smooth and glossy dorsal surface is interspersed with many minute punctures, and the margin of the body always bears a rim, even in those genera in which the female is without one, the posterior border being lobed as in the other sex. A peculiar feature of the male of *Hyalomma* and *Boophilus* is to be found in some plate-like structures on the underside and at the posterior region. Here the impressed longitudinal lines, which run from the genital orifice to the posterior margin, terminate on each side in long, lamellæ-like pieces which are, particularly at their pointed posterior region, elevated and separated from the ventral surface. A similar but smaller lamella lies externally on each side of these two larger ones.

We have hitherto studied the Tick in its free-living state, caught in the fields and in the high grass of meadows and pastures. We

know, however, that the great, the moving instinct of this animal, even in the newly-hatched, minute larva, is to fasten itself to a vertebrate animal. It prefers a mammal, on which it selects a spot where the skin is soft, and then introduces its sucking apparatus into the epidermis. The larva, of course, cannot penetrate deeply enough into the skin of the host to draw blood; but the irritation of the sting causes a suppuration, on which the young larva feeds. When, however, blood is struck, the little flat, semi-transparent creature soon becomes distended, the body rounded, and the color dark red. This state of life, stimulated by the nourishing food, hastens the process of development, and in a week the larva is transformed into the nymph, which at the expiration of another week is changed into the mature individual. Although the male lives upon the host and, like the female, fastens itself upon the skin, it has never been observed to suck blood; consequently its form and size remain unchanged and it presents the same flattened shape which it has in the free-living state.

The fact that its whole body is covered on the dorsal surface by a hard chitinous shield shows that it is unable to expand, and proves that it is not destined by nature to get nourishment from blood like the female. The male Tick seems to be tempted to dwell on the host only to be in company with the female.

It fastens itself by the rostrum, with a view of procuring a secure position under the female, so that the act of copulation may be carried on without disturbance. In examining the female while feeding upon a mammal or bird we find the body immensely distended. Pagenstecher states that the length of a full female has increased 925 per cent., for it has increased from 2.75 mm. to 1 cm.; its width shows an increase of 200 per cent., while the increase of the height is much greater, as the dorsum formerly nearly touched the ventral tegument; the body is now 5 mm. high. But this expansion is not equally represented on all parts of the body. The shield preserves the same size and in proportion to the body now appears very small.

One other part of the body also retains its former size. This is the short region between the insertion of the capitulum and the sexual opening; for during the process of egg-laying the capitulum retracts and each egg passes over it to the pedicel (by which the capitulum is connected with the body), where the egg receives

from a pair of glands a preserving coating. Were this region also expanded and the orifice removed from the capitulum, the process of egg-laying would be seriously disturbed.

The body in the mature state is provided with a number of orifices: First, the respiratory system opens externally in the stigmal plate, which is situated on each pleural side, behind and a little above the coxæ of the fourth pair of legs. The aperture of the internal tracheal system is very minute and is situated upon a little tubercle which varies in form in the different genera, and is sometimes circular, sometimes elongate or comma-shaped. This little tubercle is the *perithreme* and lies in a large, peculiar cup- or disc-like, flat, or more or less concave plate which also varies in the different genera in form and size and serves thus as a very distinct criterium in classification. It is round or oval and appears as if one corner of it had been turned over, but it has always an elevated brim, and its surface appears to be punctured by many minute perforations. It is generally coated by a white, dry, membraneous exudation which covers the punctures in a bubble or pearl-like manner.

Another orifice of the body is that of the genital apparatus in both sexes. As I have mentioned above, this aperture is situated in the anterior region of the ventral surface and often very close to the insertion of the capitulum. In other instances, and especially in the free-living state, it is removed back to the space between the fourth coxæ. The external orifice of the female genital organ forms a transversely-oval slit, surrounded by a hardened ring which is particularly distinct in the anterior region. The genital opening in the male is situated in about the same position as the female, and forms here a transverse cleft, the borders of which are slightly elevated or bulging.

The third orifice is that of the anus. It represents a longitudinally oval opening on the posterior half of the body and is furnished with two valvular lamellæ on its side and is surrounded also by an indurated ring.

The Legs: The legs of the Ticks are ambulatory organs and consequently strongly developed. The proportion of their length is about 1.000, 0.820, 0.935, 1.105, respectively.

The legs are all six-jointed, including the immovable coxal joints or plates. Some authors counted five joints, while others

have enumerated eight; but this is less because of lack of observation than of a deviation in the explanation of the principle of articulation, as we shall see hereafter.

The *coxæ* are well developed, and are situated anteriorly on the lateral border of the ventral surface. They are square or oblong or trapezoid, or sometimes subtriangular in form, covered by a darker-colored, hard chitinous plate, and are sometimes strengthened by a chitinous ring at the insertion of the next joint. They differ often in size as well as in form in the two sexes, and some of them are armed with more or less long and prominent spinous processes, or are cleft in the middle. These spines are, as a general rule, more frequently found in the male than in the female.

In *Amblyomma* the male has the first and the fourth coxæ armed with a long spine; the female has only the first coxa with a spine, the others with tubercles.

In *Hyalomma* the male has the first coxa cleft longitudinally; the other coxæ are without any processes.

The female has no tubercular nor spinous processes on any of the coxæ.

In *Ixodes* the male and female have only the first coxæ provided with a spine of varying size.

In *Dermacentor* the male has coxa I cleft, while the fourth coxa is enlarged to an immense size.

The female with coxa I like the male, the fourth not enlarged, the third pair often with a small tubercular process.

Hæmaphysalis.—The male has all coxæ provided with spines, the first the smallest, the others gradually increasing in size, the last the longest.

The female has on all four pairs small tubercular processes.

Rhipistoma.—Male and female coxæ without any processes.

Rhipicephalus.—Male and female first coxæ cleft, the rest unarmed.

Boophilus.—The male has coxa I cleft; the shape of this coxa is triangular; the rest is unarmed.

The female has on the first coxa a small tubercle; all coxæ at their posterior border with a sharp, dark chitinous ridge. The first coxæ in both sexes are here drawn out in a sharp, long, apophysis at their anterior border.

The *trochanter*, or the second joint, is the shortest. It is somewhat curved backward, narrow at the base, and wider at the apex, and is of a somewhat pear-shaped form. The first trochanter is provided in all the genera of the Rhipistomidæ at the posterior border with a broad, pointed, spinous process, which is directed backward. This armature is absent in all genera of the family of Ixodidæ. In Ixodes, however, a small pointed tubercle is noticed on the first trochanter.

The *femur*, or third joint, is of varying relative length, but always the smallest of the four articulations that follow the trochanter; it is composed of two joints which have coalesced, and the original dividing suture is more or less distinctly noticeable in all spêcies. The coalescence, however, is so perfect that there is no real articulation beween the small basal and the distal parts.

The *tibia*, the fourth joint, also varies in relative size both in the legs of the same individual and in those in the different genera.

The next joint, the *metatarsus*, is generally the shortest of the four joints following the trochanter. Of special interest is the sixth joint, the *tarsus*. This is also formed by the coalescence of two joints into one, but this is only distinct in the last three pairs. Here the division is sometimes very marked, but in some genera, as in *Amblyomma*, there is also a faint trace of a former division in the tarsus of the *first* pair.

This joint differs in shape from the other joints of the leg, for while these are evenly cylindrical and somewhat clavate—that is, their distal ends a little thicker—the tarsus tapers gradually towards the tip, and its underside is provided with two more or less prominent teeth or claws, which are placed one at the apex and the other a little further back. An exception, however, in this respect, as well as in the whole shape of this joint, is the tarsus of the first pair in all genera, for there it appears laterally flattened and becoming broader towards the last third of its length, when it quite abruptly narrows down to the end.

The tarsus of the first legs in all Antistomata (but not in the Catastomata) is provided on its dorsal surface, near the tip, with a peculiar organ, which Haller* considers an organ of hearing.

*Haller, Vorläufige Bemerk. über d. Gehörorgan der Ixoden - Zool. Anz., 1881, pp. 165, 166, with figure.

Although the construction of this organ in its principle is the same in all genera, it varies in detail; it consists of two round excavations, one behind the other, which are covered by a membrane (tympanum?), and in the lower one a long hair perforates this membrane, being inserted in the bottom of the excavation.

The tarsi of all the legs are, in the Antistomata, provided with two prominent long and slender claws which stand upon a two-jointed petiole. Between and below these claws is the caruncle, a flat, membraneous disc, with fine radiating striæ and often with a minute ciliary fringe around its circumference.

FEBRUARY 4, 1892.

Vice-President Marlatt in the chair. Thirteen members and two visitors present.

Messrs. M. B. Waite and D. G. Fairchild were elected active members of the Society.

Mr. Ashmead read the following note:

ON THE DISCOVERY OF THE GENUS EUNOTUS IN AMERICA.

By Wm. H. Ashmead.

In my paper entitled "The Insect Collections in the Berlin Museum," read before this society last June, amongst other rarities recognized in the unnamed material in the family Chalcididæ, I mentioned the discovery of the exceedingly interesting *Eunotus cretaceus*, Walker; gave a brief account of its synonomy, habits, etc., and took exception to the position assigned it by Walker, Förster, and Ratzeburg, believing it to be neither the type of a new family nor a true Pteromalid.

It gives me pleasure, therefore, to-night, so soon after the reading of this paper, to announce the discovery of a species of this interesting genus in our fauna, taken by Mr. E. A. Schwarz, near Savannah, Georgia, and to have my views as to its position sustained by my friend and colleague, Mr. L. O. Howard.

The specimen is now in the collection at the U. S. Department of Agriculture, where it may be seen at any time by our entomologists.

As the species is large and distinct from the European species, I submit the following description:

Eunotus lividus sp. n.

♀.—Length, 1.5 mm. Blue-black, closely punctate, finely sericeous; head broad, the occiput broadly concave, the occipital margin sharp: lateral ocelli a little nearer to the inner margin of the eye than to the front ocellus; eyes oval; antennæ 11-jointed (with a ring-joint which is difficult to see), inserted just above the mouth, clavate, the funiclar joints transverse, submoniliform; wings hyaline; tegulæ piceous; venation pale brown, the submarginal vein reaching the costa at about the middle of the wing, the marginal vein about twice the length of the stigmal; post marginal and stigmal veins equal; mesonotum very short, about three times as wide as long, with sharply defined parapsidal furrows; pronotum distinct but somewhat shorter than the mesonotum: scutellum large convex, with small triangular axillæ; abdomen oval, sessile, about as long as the head and thorax united, polished, impunctured, the first segment occupying nearly its whole surface; legs dark brown or blackish, with the trochanters, knees, apices of the tibiæ and the tarsi, except the terminal joint, honey-yellow,

Hab.—Near Savannah, Georgia.

Type ♀.—In U. S. Dept. of Agriculture.

Mr. Banks exhibited a male specimen of Loxosceles (family Scytodidæ), which had but six developed legs; the other two were present in the form of greatly aborted coxæ.

Dr. Marx showed a peculiar species of the Araneid genus Theridium from California, in which the mandibles of the male were as long as the whole cephalothorax.

Dr. Stiles made some remarks on a Liver Fluke story that was circulating in certain papers; this story stated that the young stages were passed in the house-fly, whereas they are passed in snails.

Mr. Mally read the following paper:

AN INSECTIVOROUS PRIMROSE.

(*Œnothera speciosa.*)

By F. W. Mally.

While making some observations in a corn field near woods at Shreveport, La., May 16, the following facts concerning the above-named species were noted. I had never collected this species before, and a number of the flowers were plucked for examination. The styles and stigmas of the full-blown flowers were loaded with small Diptera, some of which were yet alive.

In all full-blown flowers at least two or three specimens were found attached, and often as high as ten or a dozen. Careful study of a large number showed that only small Diptera were caught, and these apparently all belonging to one species.

Aside from the mere fact of the capture of these small insects, it becomes interesting to know for what purpose. Being on the stigma, with no receptacle underneath, and indeed upon an organ which soon had performed its function and fallen away with the flower, it was quite evident that they were not caught for food. Furthermore, the examination of some dried and wilted flowers led to the fact that the bodies of the Diptera were yet intact, and so far as could be determined had not been affected by any digestive process. The study of fresh specimens of flowers led to the fact that the exudate on the stigma was abundant and gummy enough to hold fast the insects, and death doubtless came to them as a result of exhaustion from constant efforts to get away. This raises the question whether the irritation of the stigmatical structure through the struggling of the insect increases the amount of the exudate. If so, the chances for fertilization are doubtless increased.

In 1873, while in Louisiana, Mr. Parey made somewhat similar observations upon this primrose, but none are more complete than those of an European observer, Prof. L. Graber, recorded in Entomol. Nachr. XIV, 1888, No. 4, p. 53, and also of Wolfensberger in Mittheil. Schweiz. Ent. Ges. VII, No. 1, 1884, p. 5. Neither notes the capture of Diptera, both having observed small noctuid moths sipping of the sweets and being unable to again get away. The moths were found to have inserted their proboscis down to the exudate-producing glands. The opening to these being rather small, they were unable to withdraw their tongues and fly away. Prof. Graber made a careful study of the structure and anatomy of the essential organs of the flower and the passages through which their tongues passed, but found no provision of any kind which could be considered as having the function of holding fast the insect. He concludes, quite justly, that they are not caught for food, and indeed perhaps quite unintentionally. The capture seems to be due to the peculiar and special desire for it which the exudate, when sipped, develops for itself, inducing the moth to force in its proboscis beyond redemption. In other words, the unfortunate insects seem to become victims of their appetites and greed rather than from any intentional design of a vegetal nature.

From the foregoing it will be noted that this primrose cannot be considered insectivorous in the common acceptance of that term, namely, for food. On the other hand, Prof. Graber found that when the moths were freed by being pulled away from the flower they at once resumed flight without apparent difficulty.

Hence the exudate, or the plant, strictly speaking, cannot be called "insecticidal" any more properly than "insectivorous." The peculiar attractiveness above noted doubtless serves the plant some special purpose, and until the real nature of this is determined the designation given in the heading must of course be understood as provisional.

Mr. Howard then presented a paper entitled—

THE HYMENOPTEROUS PARASITES OF SPIDERS.

By L. O. Howard.

I have for some time been interested in the subject indicated by the title of this paper and have published several short notes with descriptions of species in the first three volumes of *Insect Life*. Material has accumulated on my hands, however, to such an extent that I have thought it well to bring it all together into convenient and accessible shape. The biological facts here given have been transmitted to Rev. H. C. McCook for publication in the third volume of his large work upon "Spiders and Their Spinning Work." A systematic statement, however, is given below with descriptions of all new species and all of the facts so far connected with their life histories except where previously published. In the latter case references are given. I have followed this statement with a tabular list of the European hymenopterous parasites of spiders so far as I have been able to find them recorded. This list is taken from a manuscript catalogue of the host relations of parasitic Hymenoptera upon which I have been engaged for some time. It should be stated concerning this list that the bibliographical references in the third column do not give in many cases the name of the original observer or even the reference to the first publication, as I have, in order to save time, catalogued mainly published lists of host relations, thus taking advantage of the compilation work done by other workers. As a result Blackwall's rearings, for instance, while not credited in the reference column to that author, may appear under Bridgman or Fitch or some other author, as the case may be. I have confined myself to the consideration of the hymenopterous parasites, although several Diptera are known to infest spiders and their cocoons; thus certain flies of the Muscid genus Leucopis are said by Schiner to live in the nests of spiders, while Menge states that the larva of Oncodes inhabits the sac of Clubiona and devours the spider. Moreover, the curious hypermetamorphoses of Mantispa have been proved by Brauer to take place in the egg sacs of spiders of the genus Lycosa.

Nos. 17 to 21, inclusive, of the American list, belonging to the Ichneumonid genus Hemiteles and the Chalcidid genus Eupelmus have been kindly described for me by Prof. Riley, on account of his particular interest in these two genera.

AMERICAN HYMENOPTEROUS PARASITES.

1. **Polysphincta** sp.

A larva which was not reared to the adult, but which probably belonged to Polysphincta, was found feeding externally upon *Steadota borealis* Hentz in the District of Columbia. W. H. Fox collector.

See *Insect Life*, Vol. I, p. 42.

2. **Polysphincta (Zatypota) dictynæ** How. *Insect Life*, Vol I, p. 106.

This species was reared from a larva feeding externally upon *Dictyna volupis* by J. H. Emerton, at Waltham, Mass.

3. **Polysphincta (Zatytopa) strigis** n. sp.

Female.—Length, 5 mm.; expanse, 10 mm. Body black, with delicate whitish pubescence; mesonotum and mesopleura dark honey-yellow, mesoscutum with three dark longitudinal bands; all coxæ and trochanters, front and middle femora, and front tibiæ and tarsi light ochre-yellow; middle tibiæ with a brown band at tip; tarsi brown, except base of first joint; hind femora brown above, whitish below; basal three-fourths of hind tibiæ whitish, apical fourth dark brown, nearly black, with a brownish spot near base above; hind tarsi dark brown except base of first joint, which is whitish; abdomen yellowish below at base; palpi yellowish white; mandibles brown at base and extreme tip, otherwise yellowish; clypeus brown; wing veins dark brown; tegulæ yellowish white. Abdomen nearly smooth; terebra exserted to a length equal to the last three joints of the abdomen. No trace of a cubital cross-vein in the forewings, although the cubital vein is bent at quite a sharp angle. Fifth tarsal joint subtriangular in shape, about as long as third; pulvillus large. Metascutellum with two longitudinal median carinæ, slightly diverting posteriorly.

Described from one female specimen.

The larva of this species was found feeding externally upon *Epeira strix* by Nathan Banks at Sea Cliff, Long Island, May 11, 1891. At the time of capture the parasitic larva was considerably larger than the spider. The larva spun up May 14. When brought to me, May 18, the cocoon was completed in the vial in which Mr. Banks had placed the specimen. The cocoon was of a densely spun yellow-brown silk, 6 mm. long, cylindrical, 2 mm. in diameter, and rounded at both ends. It was suspended by a loose band of darker colored, coarser silk 7 mm. long, and

from the end of this band a few threads reached to the bottom (27 mm.) and sides of the vial. At the opposite end of the cocoon from the supporting band were 7 oblong, black excremental pellets evidently extruded by the larva before closing itself in the cocoon. The abdomen of the spider was reduced to almost nothing, but the cephalothorax and legs remained natural. May 25 the adult issued from the opposite end of the cocoon from the excrement.

The cocoon of *P. dictynæ* mentioned above was of about the same size and had a smaller supporting band, but was composed of white silk and was much more delicate (nearly transparent).

4. **Polysphincta** sp.

Larva not reared. Feeding externally upon the abdomen of *Linyphia communis* Hentz. Collected at Beverly, Mass., August 28, 1869, by J. H. Emerton.

5. **Polysphincta** sp.

Shrunken larva only. Found in cocoon attached to dead spider of the Attid genus Icius. Collected at Eastport, Maine, August 18, 1872, by J. H. Emerton.

6. **Polysphincta** sp.

Larva not reared. Collected on the dorsum of *Theridium spirale* (?) by J. H. Emerton. (Neither date nor location.)

7. **Polysphincta** sp.

Known only by the larva, which was found attached to a specimen of *Pardosa luteola* Marx in a collection of spiders from Ounalaska.

8. **Polysphincta theridii** n. sp.

Length, 5.4 mm.; expanse, 8 mm. Belongs to the true genus *Polysphincta* as differentiated from *Zatypota* Förster, *Oxyrrhexis* Först. and *Zaglyptus* Först. by Schmiedeknecht's tables (Zool. Jahrbücher III, 3, 432 3). The cubital cross-vein is represented by a distinct stump closely proximad of the angle of the cubital, which is slightly marked. Metascutellum with two parallel median longitudinal carinæ diverging widely behind and bordering a pentagonal space which is slightly and irregularly longitudinally ridged; first segment of abdomen with two dorsal median longitudinal subparallel carinæ diverging anteriorly and converging at posterior end of segment to form a distinct tubercle; second and subsequent abdominal segments each with a well-defined finely punctate space shaped much like the black markings on the abdomen of *P.* (*Zatypota*) *dictynæ* (See fig. 1). General color dull black; all legs uniform honey-yellow, except that hind tibiæ are brown at the tips; scape and pedicel of antennæ honey-yellow; palpi honey-yellow, clypeus darker.

Described from two ♂ specimens received from J. H. Emerton, and each labelled "from cocoon in nest of Theridium, Eastport,

Me., August, 1872." Both specimens are in bad condition and are covered with a chalk-like deposit and bits of spider's silk.

9. **Polysphincta (Zaglyptus) koebelei** n. sp.

Female.—Length, 8 mm.; expanse, 11 mm. Resembles quite strongly *P.* (*Zatypota*) *strigis*, except in the main structural character that the cubital cross-vein is plainly represented by a short stump, just proximad of the angle in the cubital. The subparallel metascutellar carinæ are also lacking, this sclerite being marked only by a delicate median longitudinal impression which is lacking on the apical half. The plan of coloration is the same, but the following differences may be noted: hind coxæ black at base; all other crural sclerites uniform honey-yellow; mesonotum of a more uniform and lighter honey-yellow; metascutum honey-yellow.

Described from one female specimen received from A. Koebele, and labelled "Santa Cruz Mountains, Calif." Upon the tag with the specimen is the shrivelled body of a spider upon which it is fair to presume that the parasitic larva had been feeding, the more especially since the spider's abdomen has been destroyed. Attached to the same pin is what is evidently the cocoon of the parasite. It is 7.5 mm. long and 3.8 mm. wide, is rather loosely spun (so as to be translucent) of light brown silk. The spider has been determined from its remains by Dr. Marx as *Epeira strix* or *E. scolopetaria.*

Other references to the interesting external parasites of the Polysphincta group will be found under the head of "European Parasites." Still others will be found in the original note in *Insect Life*, Volume I, p 43. It was supposed at the time that this was the first American record of an external spider parasite, but Mr. Schwarz has recently called my attention to a note in the Proceedings of the Boston Society of Natural History for 1871, Volume XIV, p. 388, which reads: "Mr. F. G. Sanborn reported a recent capture of a spider of the genus Lycosa (?) upon which was a parasitic larva apparently dipterous."

10. **Pimpla rufopectus** Cresson. *Trans. Am. Ent. Soc.* III, p. 148.

Three female specimens reared from spider's egg-bag (probably Epeirid), Alameda county, Cal., June 10, 1887, by A. Koebele. (See *Insect Life*, Vol. III, p. 461.) Also reared by W. H. Patton in Connecticut, in May, from the cocoon of an Epeirid spider. Also two females reared in the District of Columbia by O. Heidemann. Three female specimens reared from an egg-bag of *Argiope riparia*, February 22, 1889. Received from H. C. Wells, Short Hills, N. J. (See *Insect Life*, Vol. I, p. 324, where it is named *P. inquisitor.*) This is also the species referred to by Dr. Burt G. Wilder in the Proceedings of the A. A. A. S. for 1873, p. 257, and also in a popular article in *Harpers'*

Magazine for March, 1867. I have not seen the adult insect, but Dr. Wilder a number of years ago sent me the cocoons.

11. **Pimpla scriptifrons** Cresson. *Trans. Am. Ent. Soc.*, III, p. 148.

Eleven males and one female reared from white cocoons in the egg-sac of *Argiope riparia*, District of Columbia, April, 1889. (See *Insect Life*, Vol. III, p. 462.)

12. **Pimpla japonica** Ashm. mss.

One specimen reared from spider's egg from Japan. (See *Insect Life*, Vol. III, p. 463.) This may be a Japanese species.

13. **Pimpla aquilonia** (?) Cresson. *Trans. Am. Ent. Soc.*, III, p. 145.

One female specimen of what may be this species reared from eggs of *Epeira angulata*, by Dr. A. Davidson, at Los Angeles, Cal. Cresson's species was described from the male sex only and from Maine. It is, however, the only described species which Dr. Davidson's specimen resembles, and although the localities are separated by the entire continent they may prove identical.

14. **Pezomachus unicolor** Cresson. *Can. Entom.*, Vol. IV, p. 64.

One female specimen collected on a fence across a meadow with many spiders, at Dedham, Mass., November 9, 1873, by J. H. Emerton. I think this species was not actually reared, but there is little doubt but that it is a spider parasite.

15. **Pezomachus obscurus** Cresson. *Can. Entom.*, Vol. IV, p. 62.

Four female specimens reared by F. M. Webster, at Columbus, Ohio, from the cocoons of a species of Micaria.

16. **Pezomachus micariæ** n. sp.

Female.—Length, 5 mm; ovipositor nearly as long as last three abdominal segments; antennæ short, stout, not longer than head and thorax together. General color dull rufous, basal five joints of antennæ lighter; sutures of thorax and dorsum of abdomen behind the petiole black, the second, fifth, sixth, and seventh abdominal segments edged with rufous behind, the band on the second segment widest; mandibles yellow at base. Head, thorax, and abdomen very finely shagreened, shining.

Male.—Length, 6 mm.; expanse, 12.4 mm. The rufous color applies to entire abdomen and all legs, as well as to mandibles and mouth-parts. Head and thorax dull black and delicately shagreened, except metanotum, which is finely rugosé and furnished with delicate irregular carinæ forming a wide reticulation.

Described from one male and one female, each reared from an egg cocoon of Micaria, by J. H. Emerton, at Salem, Mass.

17. **Hemiteles prosthesimæ** Riley sp. n.

Male.—Length, about 5.5 mm. *Head* black, opaque, densely but finely granulate, and with a fine, short pubescence; eyes large, convex; ocelli in a triangle, pale; clypeus smooth, not distinctly separated at base;

mandibles and palpi pale ferruginous; antennæ long, black, the basal two joints ferruginous, the first being sub-globose and obliquely truncate at apex. *Thorax* black, sculptured and pubescent like the head; mesonotal furrows only slightly indicated anteriorly; scutellum smoother than the surrounding surface, shining, in marked contrast to the mesonotum, with a transverse fovea at base; the long, lateral foveæ of the postscutellum crenate or striate at bottom; metathorax distinctly areolated, the central or middle area hexagonal; the surface of the petiolar area and the lateral area transversely rugulose; spiracles small, oval; mesopleura with a series of ridges below tegula and smooth toward the posterior margin, shining, with a deep fovea at the middle; wings hyaline; tegulæ and a spot at the base of the stigma whitish, the nervures ferruginous, the stigma fuscous, third discoidal cell more than twice the length of the second, the discoidal nervure simple, not broken by a stump of a cubital nervure; transverse median nervure in hind wings broken very near the base; legs rufous. *Abdomen*, with the petiole black except toward posterior border, the spiracles placed behind the middle; the other joints rufous, smooth, impunctate; joint 2 one-half longer than 3.

Hab.—Salem, Mass.

Described from a single male specimen reared April 19, 1872, by J. H. Emerton, from a cocoon of *Prosthesima furcata*.

This species comes nearest to *H. townsendi* Ashm. in size and color, but is different in sculpture and in the venation of hind wing. The surface of *H. townsendi* is smooth, shining, sparsely punctate, the transverse median vein in hind wing being broken a little below the middle, while in *H. prosthesimæ* the surface is closely, densely granulate, the transverse median nervure in hind wing being broken very close to the base.

18. **Hemiteles micarivora** Riley sp. n.

Male.—Length, 4 mm. *Head* black, opaque, densely, closely granulate, with a few large sparse punctations, and with a fine, short pubescence; the clypeus distinctly separated and sculptured as the face; mandibles rufous; antennæ as in *H. prosthesimæ*; also the scutellum and the metathorax, except that the surface of all the areas is rugulose and the dorsulum of postscutellum is striate. *Thorax* colored and sculptured like the head; wings with the venation darker than in *prosthesimæ*, although the tegulæ and a spot at the base of stigma are white; third discoidal cell only about twice as long as the second; discoidal nervure broken by a stump of a cubital nervure; legs obscure rufous, the tarsi slightly fuscous, as also the knee and terminal part of tibiæ in hind pair. *Abdomen* smooth, rufous, posterior part of fourth and all of following joints black; joint 2 not quite one-half longer than 3; petiole faintly striate, the spiracles near anterior third.

Hab.—Washington, D. C.

Described from one specimen reared, by O. Heidemann, from the cocoon of a species of *Micaria*.

In the color of the abdomen and in having a distinct stump of a cubital nervure, this species is distinct from all others in our fauna, but otherwise it closely resembles *H. drassi*, described below.

19. **Hemiteles drassi** Riley sp. n.

Male.—Length, 4.5 mm. Agrees with *H. micarivora* except as follows: The face has no large punctations; mandibles are piceous; palpi white; dorsulum of postscutellum closely punctate; not striate; posterior tibiæ and tarsi fuscous; the second and third abdominal segments and the extreme apex of petiole and base of fourth segment are rufous; the rest of the abdomen black; while the discoidal nervure is simple and not broken by a stump of a cubital nervure.

Hab.—Columbus, Ohio.

Described from two male specimens reared, by F. M. Webster, from cocoons of a Drassid spider.

The three species of Hemiteles above described by Mr. Howard's desire occur,. unfortunately, in the male sex only, and on account of the divergence which often occurs between the two sexes in this genus it will be difficult to connect the females with them until they have been reared together. It seems desirable, however, to characterize the species in this connection, even though the characterization be necessarily incomplete. [C. V. R.]

20. **Eupelmus piceus** Riley sp. n.

Female.—Length, 3.1 mm.; ovipositor, 0.80 mm.; width of head, 1 mm. Æneous-black, with bronzy and metallic reflections. Head and thorax above (except the mesonotal depression, which is smooth and shining) finely shagreened; lower part of face and cheeks metallic green, the cheeks below the eye finely striolate; trochanters, anterior and middle femora, tibiæ and tarsi *beneath*, posterior femora at tip and the ovipositor, ferruginous; femora and posterior coxæ with a metallic æneous tinge, the latter with some silvery-white hairs, while the rest of the legs are blackish. Wings hyaline, with a large, fuliginous discal blotch below the marginal nervure; tegulæ large, dull fuscous; mesopleura blue-black, finely and longitudinally aciculate toward posterior margin. Head very broad, wider than the thorax across the wings, fully three times as wide as long antero-posteriorly, the occipital region broad, slightly and roundedly emarginate; ocelli triangularly arranged, face broad, flat, without a trace of the antennal furrow; eyes large, elliptic, divergent anteriorly, the face, in consequence, being wider below than above; anterior edge of clypeus and the mandibles ferruginous; palpi blackish. Antennæ widely separated at base, inserted just above the clypeus, slender, the flagellum about twice

he length of the scape, very slightly thickened and obliquely truncate at ip, black; the scape is cylindrical, slender, pale ferruginous, and does not reach beyond the anterior ocellus. Collar triangular, the posterior margin emarginate; prosternum rhomboidal with a central impressed line; mesonotum impressed, trilobed, of the usual shape in the genus, the middle lobe convex, terminating at two-thirds the length of the mesonotum, shagreened, the lateral lobes carinate, the depressed space between and the posterior edge of middle lobe smooth, shining, impunctate; scutellum large, subconvex, rounded, the lateral pieces at base triangular; metathorax obliquely sloping with a deep central channel, the metapleura smooth with the spiracles elliptic and placed at their base. Abdomen ovate, truncate behind, flat above, boat-shaped beneath, the first segment the longest, segments 2 to 5 shorter, about equal, the following retracted or shortened.

Male.—Length, 2.1 mm. Agrees with the ♀ in color, except that the legs are not ferruginous beneath and the middle and posterior tarsi are white; wings clear hyaline, with the nervure pallid. It differs structurally in not having the mesonotum impressed, but showing only slight impressions between the middle and lateral lobes; eyes finely pubescent; the mesopleura have a distinct femoral furrow or impression; middle tarsi not dilated and combed or pectinate beneath, the posterior tibiæ being compressed.

Hab.—California.

Described from 1 ♂ and 2 ♀ specimens received from Dr. H. C. McCook, reared July 27, 1891, from the eggs of a spider, *Argiope argentata.*

In the very wide head, the absence of antennal furrows, the widely separated antennæ, and the flat hind tibiæ of the ♂, this species is easily separated from any described Eupelmid. It comes nearest to *Metapelma* Westwood, but in this genus the posterior tibiæ and tarsi in both sexes are broadly dilated, the middle legs being normal, while there are other characters that separate it.

21. **Eupelmus drassi** Riley n. sp.

Female.—Length, 3 mm. Head golden green, closely punctate; thorax at sides and beneath, and legs, light brown or brownish yellow; the upper concave surface of the collar violaceous; mesoscutum blue-green, sparsely covered with a short, whitish pubescence; scutellum metallic brown; axillæ reddish yellow; metathorax greenish; the metapleura distinctly violet; mesopleura posteriorly dusky; middle tibiæ, except distal ends, and the hind legs, except the coxæ behind and on the knees, fuscous; hind coxæ behind black; all tarsi, except the last joint, yellowish.

Antennæ (broken after the third joint) with the scape brownish yellow, the joints of the flagellum which are left brown. Front wings, except the basal one-third which is hyaline, fuscous with an interrupted transverse band beyond the middle, composed of two large oblong white spots that

start from each margin behind the base of the stigmal vein, and are obliquely directed toward the basal middle of the wing, but do not quite meet each other; marginal vein very long, fully as long as the submarginal, the stigmal vein small, only about one-third the length of the postmarginal; hind wings hyaline. Abdomen clavate, broadened behind, scarcely two-thirds the length of the thorax, blue-black, the first or basal segment pale, the venter somewhat greenish, the ovipositor not exserted, only the tip slightly exposed and that is white.

Described from one ♀ specimen reared by Miss Mary E. Murtfeldt, September 21, 1891, from a spider's nest which Dr. Marx identifies as probably belonging to a *Drassus* sp.

This belongs to *Antigaster* Walsh. [C. V. R.]

22. Holcopelte nitens n. sp.

Female.—Length, 1.6 mm.; expanse, 2.6 mm.; greatest width of forewing, 0.8 mm. Head delicately shagreened, with a smooth spot between ocelli and one just before anterior ocellus; mesonotum also finely shagreened; metanotum with three median longitudinal carinæ, the middle one flattened on top and smooth and glistening, and a smooth space laterad of each of the outer carinæ; abdomen smooth, glistening. Bristles of thorax black; pile of head and abdomen whitish; eyes with close whitish pile. General color black, shining, with metallic reflections, those of head, mesoscutum, and metanotum greenish, those of scutellum bluish; abdomen glistening but without colored reflections, all coxæ metallic, all other sclerites of all legs pale, whitish, almost translucent; antennal scape whitish, concolorous with all femora, tibiæ, and tarsi; rest of antenna metallic with close whitish pile.

Male.—Length, 1.3 mm.; expanse, 2.6 mm.; greatest width of forewing, 0.5 mm. Differs from female only in usual sexual differences in this genus, except that the metallic colors are brighter and the dorsal surface of abdomen has bright golden reflections.

Described from two male and five female specimens reared from egg-bag of Epeira at Washington, D. C., by Nathan Banks. This species is without much doubt hyper-parasitic, primarily infesting some Ichneumonid in the spider cocoon.

23. Mestocharis wilderi n. sp.

Female.—Length, 1.5 mm.; expanse, 2.7 mm.; greatest width of forewing, 0.56 mm. Front delicately transversely shagreened; occipital ridge elevated and acute; occiput densely punctulate; mesoscutum densely and finely punctulate; mesoscutellum longitudinally shagreened; metascutum with a small, deep, nearly round, central fovea; median longitudinal carina of metascutellum well marked and dividing just beyond middle of sclerite into two latero caudally directed arms; dorsum of petiole markedly punctate; remaining abdominal tergites very faintly granulate. General

color shining black; head and thorax with greenish-blue reflections; first, second, and third tarsal joints of all legs light yellowish.

Male.—Closely resembles female except in ordinary sexual differences of antennæ and abdomen. The head and thorax, however, have a bright coppery or golden lustre.

Of this species I have several male and female specimens reared by Dr. B. G. Wilder, at James Island, S. C., from the cocoons of *Pimpla*—probably *rufopectus*—within the egg-cocoons of *Epeira riparia*, collected between March 21 and April 2. Also four male specimens reared by Col. Nicholas Pike, at Brooklyn, N. Y., 1880, from cocoon of *Argiope riparia*. Also many male and female specimens reared, by Nathan Banks, at Sea Cliff, L. I., from cocoons of the same spider. Also 11 male and female specimens reared from a parasitized cocoon of an Epeirid collected at Washington, D. C., by the writer. Also 5 male specimens reared from cocoon of *Epeira angulata* infested by *Pimpla aquilonia* (?) at Los Angeles, Cal., by Dr. A. Davidson.

24. **Tetrastichus banksii** n. sp.

Female.—Length, 1.8 mm.; expanse, 3.1 mm.; greatest width of fore-wing, 0.6 mm. Head and face with coarse punctures, which on the face are arranged in four rows, one down each side of antennal groove and one down the border of each eye; mesonotum delicately longitudinally striate, median furrow of mesonotum sharp and continuous with a faintly indicated median longitudinal furrow of the scutellum; just mesiad of the parapsidal furrows of the mesoscutum is a row of deep, large punctures, which is continuous with the impressed lateral furrows of the scutellum; these lateral scutellar furrows are continuous but seem composed of a chain of punctures; metascutum impressed in centre, the impression bearing a central papilla; meta-scutellum with a median longitudinal carina, each side of which is a strongly rugose surface; pro-, meso-, and meta-pleura closely punctate; abdomen smooth, shiny, concave above behind the second segment through drying. General color black, with faint greenish metallic reflections; scape of antennæ honey-yellow; mandibles honey-yellow; all coxæ and femora metallic, yellowish at joints; all tibiæ and tarsi light-brown with a darker shade above at base of tibiæ.

Described from three female specimens reared from egg-bag of an Epeirid at Washington, D. C., by Nathan Banks, together with seven specimens of No. 22—*Holcopelte nitens*. This species is undoubtedly hyperparasitic, but whether it is primarily parasitic upon Holcopelte, or upon some Ichneumonid, the Holcopelte being then parasitic upon the Tetrastichus, is uncertain.

25. **Bæus americanus** How. *Insect Life*, Vol. II, p. 270.

Several male specimens reared from Epeirid eggs by Col. Nicholas Pike, Brooklyn, N. Y. Also several males and one female

from spider's eggs in an orange cocoon collected by J. H. Emerton in 1871. (See *Insect Life*, Vol. II, p. 359.)

26. **Acoloides saitidis** How. *Insect Life*, Vol. II, p. 270.

Nine males and one female reared from the eggs of *Saitis pulex*, by Lawrence Bruner, at Lincoln, Neb. Also 12 females reared from a spider egg-sac at Oxford, Ind., October, 1884, by F. M. Webster. (See *Insect Life*, Vol. II, p. 359.) Also 11 specimens reared in September, by Prof. C. V. Riley, from eggs of *Phydippus morsitans*, Washington, D. C.

27. **Acoloides emertonii** How. *Insect Life*, Vol. IV, p. 202.

Seven female specimens reared, by J. H. Emerton, from egg-cocoon of an unknown spider.

28. **Acolus zabriskiei** Ashmead ms.

Two males of an undescribed species to which Mr. Ashmead will give this name were reared by Rev. J. L. Zabriskie at Flatbush, L. I., from the small orange-colored cocoon of an unknown spider.

European Hymenopterous Parasites.

Parasite.	*Host.*	*Reference.*
Hemiteles similis	Epeira diadema	Giraud et Laboulbène, Liste d'éclosions d'insectes, *Ann. Soc. Ent. France*, 1877, 402. J. B. Bridgman, *The Entomologist*, XVI, 106.
Hemiteles similis	Spider's nest	Bridgman, *loc. cit.*
Hemiteles melanarius	Spider's eggs	Bridgman, *loc. cit.*, 108.
Hemiteles palpator	Aranea	Ratzeburg, Ichn. d Forst insecten, Wirths-System.
Hemiteles palpator	Spider's egg-bag	Bridgman, *loc. cit.*
Hemiteles fasciipennis	Spider cocoons	Brischke, Allgemeine Wirths-System.
Hemiteles rufocinctus	Aranea	Ratzeburg, *loc. cit.*
Hemiteles formosus	Agalena brunnea	Bridgman, *loc. cit.*
Hemiteles fulvipes	Aranea	Ratz., *loc. cit.*
Hemiteles fulvipes	Spider's eggs	Bridg., *loc. cit.*, Kirchner, Cat. Hym. Eur., 65.
Hemiteles fasciatus	Spider's eggs	Kirch., *loc. cit.*
Hemiteles tristator	Epeira diademata eggs	Brischke, *loc. cit.*; Bridg.: *loc. cit.*, 107.
Hemiteles tenerrimus	Agalena brunnea nests	Bridg., *loc. cit.*, 108.

Parasite.	*Host.*	*Reference.*
Hemiteles tenerrimus	Pedunculate spider cocoons	Giraud et Laboulbène, *loc. cit.*
Hemiteles aranearum	Agalena brunnea nests	*Ibid.*
Hemiteles fragilis	Spider cocoons	Brischke, *loc. cit.* Bridg., *loc. cit.*
Hemiteles, 3 spp	Spiders' nests	Bridg., *loc. cit.*, XV.
Mesochorus aranearum	White spiders' nests	Kirchner, *loc. cit.*, 97.
Mesochorus aranéarum	Aranea	Rtz., *loc. cit.*
Cryptus titillator	Spider cocoon	Snellen van Vollenhoven, Pinacographia, 10; Bridg., *loc. cit.*, XVI, 35; Kirch., *loc. cit.*, 56; Ratz., *loc. cit.*; Brischke *loc. cit.*
Cryptus annulitarsis	Spider cocoons	Brischke, *loc. cit.*, 166.
Pimpla rufata	Spider cocoons	Ratz., *loc. cit.*, Gir. et Lab., *loc. cit.*, 410; Kirch., *loc. cit.*, 106.
Pimpla angens	Spider cocoons	*Do.* all refs.
Pimpla scanica	Spider cocoons	Brischke, *loc. cit.*
Pimpla brevicornis	Spider cocoons	Brischke, *loc. cit.*
Pimpla ornata	Spider cocoons	Brischke, *loc. cit.*
Pimpla ovivora	Spider cocoons	Snellen, *loc. cit.*, 34; Brischke, *loc. cit.*
Pimpla oculatoria	Spider cocoons	Snellen, *loc. cit.*
Pimpla oculatoria	Epeira diadema eggs	Gir. et Lab., *loc. cit.*, 409.
Polysphincta boops	Spider	Brischke, *loc. cit.*
Polysphincta boops	Theridion sp	E. A. Fitch, *The Entomologist*, 40.
Polysphincta boops	Epeira diademata	*Ibid.*
Polysphincta carbonator	Aranea	Ratz., *loc. cit.*
Polysphincta carbonator	Miranda (Epeira) cucurbitina	Fitch, *loc. cit.*
Polysphincta carbonator	Epeira antriada	*Ibid.*
Polysphincta carbonator	Epeira diademata	*Ibid.*
Polysphincta carbonator	Spider's eggs (?)	Kirchner, *loc. cit.*
Polysphincta rufipes	Spider cocoons (?)	Brischke, *loc. cit.*
Polysphincta rufipes	Epeira diademata	Fitch, *loc. cit.*

Parasite.	*Host.*	*Reference.*
Polysphincta tuberosa	Spider	*Ibid.*
Acrodactyla degener	Two sp. of spider	O. P. Cambridge, *The Entomologist*, XV.
Pezomachus corruptor	Agalena brunnea nests	Gir. et Lab., *loc. cit.*, 402.
Pezomachus cursitans	Spider cocoons	Brischke, *loc. cit.*
Pezomachus fasciatus	Spider cocoons	*Ibid.*, Kirch., *loc. cit.*, 59.
Pezomachus fasciatus	Agalena brunnea nests	Gir. et Lab., *loc. cit.*, Snellen, *loc. cit.*, 20, Kirchner, *loc. cit.*, 61.
Pezomachus fasciatus	Theridion sp	Cambridge, *loc. cit.*, XIV, 137.
Pezomachus instabilis	Aranea	Ratz., *loc. cit.*
Pezomachus proximus	Agalena brunnea cocoons	Gir. et Lab., *loc. cit.*
Pezomachus vagans	Spider's nest	Bridg., *loc. cit.*, XV.
Pezomachus zonatus	Agalena brunnea cocoons	Gir. et Lab., *loc. cit.*, 403.
Pezomachus zonatus	Spider cocoons	Brischke, *loc. cit.*
Macrocentrus linearis	Spider cocoon	Gir. et Lab., *loc. cit.*, 412.
Microgaster aranearum	Aranea	Ratz., *loc. cit.*
Microgaster perspicuus	Aranea	*Ibid.*
Microgaster deprimator	Spider cocoon	Brischke, *loc. cit.*
Pteromalus ater	Aranea	Ratz., *loc. cit.*
Pteromalus punctatus	Aranea	*Ibid.*
Entomacis, 2 spp	Spider's cocoon	A. Förster, Hymenopterölogische Studien, II, 123.

EXPLANATION TO PLATE.

Fig. 1. *Polysphincta* (*Zatypota*) *dictynæ* How.: *a*, adult; *b*, larva attached in natural position to spider—enlarged (from *Insect Life*).
Fig. 2. *Bœrus americanus* How.; female—greatly enlarged (same source).
Fig. 3. *Acoloides saitidis* How.; female, enlarged, showing wing veins, ♂ antenna and side view of meso- and metanotum—still more enlarged (same source).

Mr. Ashmead remarked that he had seen mites of the genus *Bryobia* in spider cocoons, but did not know whether they were there as parasites or hibernating. Mr. Howard thought that they must be hibernating, as *Bryobia* is a vegetable feeder. Mr. Marlatt said that *Bryobia* could not be a parasite, but crowded into any convenient place to hibernate. He further remarked that he had often opened spider cocoons soon after they were

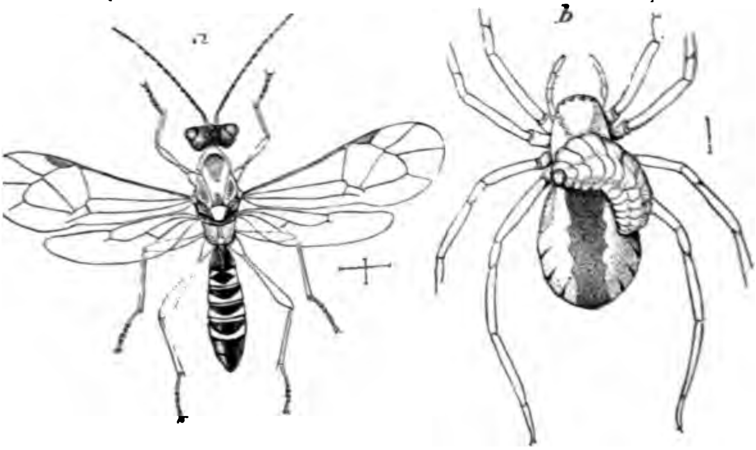


FIG. 1.

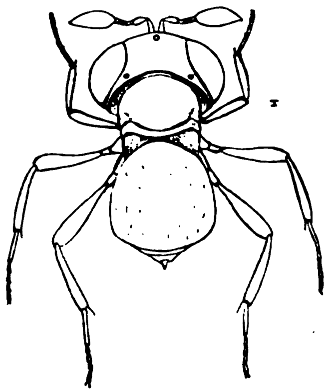


FIG. 2.

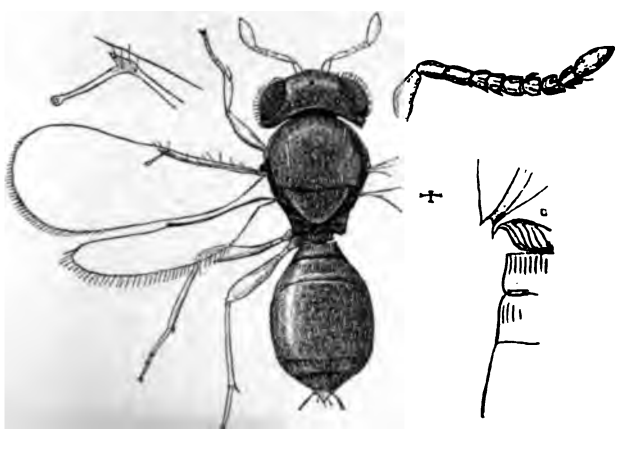


FIG. 3.

made, and had always found young spiders instead of eggs. He thought that some species might be viviparous. Various other members stated that they had always been able to find eggs in spider cocoons.

Dr. Stiles made some remarks on the Nematode parasites of insects, stating that there were three genera, *Mermis*, *Gordius*, and *Oxyura*, which are frequently confused by entomologists. He thought that entomologists should be more careful in naming the species which they chance to observe, so that helminthologists may have more accurate data for reference.

Prof. H. E. Summers was invited to speak, and made some remarks on collecting, particularly in the tropics. He thought that entomologists should be much more careful and exact, both as regards locality and date, as upon these facts much of our knowledge of the life of insects depends. He illustrated his points by reference to several interesting personal experiences in Trinidad and Venezuela, and particularly emphasized the necessity of a prolonged stay and close collecting even in limited areas in tropical countries on account of the narrow distribution of many forms. He insisted upon the consequent value of very exact locality labels.

March 3, 1892.

President Riley in the chair. Eighteen members and one visitor present.

Mr. Wm. Ross Harris was elected a corresponding member.

Dr. Stiles discussed the histology of *Boophilus bovis* (Riley) Curtice, illustrating his paper with microscopic preparations. He has furnished the following abstract:

THE HISTOLOGY OF BOOPHILUS.

By C. W. Stiles, Ph. D.

[*Author's Abstract.*]

The subjects treated were: the structure of the exterior cuticle; the presence of more than one pair of stigmata in the larva; the structure of the hypodermis; the peculiar large cells with enormous star-shaped nuclei, derived from the hypodermis and serv-

ing as matrix to the hairs; the change in form of the œsophagus which acts as a pump in sucking the blood; the course of the œsophagus through the brain; the large epithelial cells of the intestine; the structure of the brain; histology and topographical anatomy of the muscles; the differentiation of the glands of the head into three distinct kinds; the microscopical anatomy and histology of the excretory and genital organs.

Dr Gill read a paper entitled "The larva of insects an intercalated stage," of which the following is a summary:

THE LARVA OF INSECTS AN INTERCALATED STAGE.

By Theodore Gill, M. D., Ph. D.

[*Author's Abstract.*]

The vermiform larval stage of insects, manifested under the form of caterpillars, grubs, or maggots, was regarded by the old naturalists as a primitive condition and proof of the inferiority of the worms in a systematic sequence. This view was especially urged by one author who enjoyed a great popular reputation in his day in a memoir which long had influence on American entomology—"The classification of insects from embryological data," by Prof. Louis Agassiz, published in 1850.

It was contended by the speaker that the specialized larval condition, as the caterpillar or grub, was rather an intercalated stage. The geological record especially seemed to indicate that such was the case. The predominant insects of the paleozoic epoch were representatives of orders without a vermiform stage or were evidently related to the representatives of such orders as the *Orthoptera* and *Neurorthoptera*. Data in support of this view compiled from recent works by Mr. Scudder were furnished..

The diversity of the larval stage among insects similar in their imaginal stages was also adduced in evidence.

April 7th, 1892.

President Riley in the chair. Nineteen members and one visitor present.

Mr. Geo. D. Bradford, of New York, was elected a corresponding member.

The first half hour was devoted to a discussion of Dr. Gill's paper presented at the last meeting. Dr. Gill stated the main features of his paper, after which it was discussed by Messrs. Stiles, Smith, Riley, Gill, Banks, and Ashmead.

Dr. Riley then read the following papers:

ON CERTAIN PECULIAR STRUCTURES OF LEPIDOPTERA.

By C. V. Riley.

1. The Radiate Bodies in the Receptaculum Seminis of Pronuba and Prodoxus.

In preparing a résumé of the facts connected with Yucca pollination for the Annual Report of the Missouri Botanical Garden, I had occasion lately to characterize definitely the undescribed species of Pronuba and Prodoxus, and in connection with the descriptions presented herewith for publication I would call attention to some of the peculiar structures of these remarkable insects. *Pronuba synthetica* pollinizes *Yucca brevifolia*, and is a rather anomalous Lepidopteron, bearing a striking superficial resemblance to certain saw-flies of the genus Dolerus, as also to certain Neuropterous species of the family Sialidæ. Aside from the curious maxillary tentacles and serrate ovipositor of the female, peculiar to the genus, the body is flattened and the scales of the wings so loosely attached and so sparse that they disappear as readily as in the case of the Sesiidæ, and are seen in perfection only in the recently emerged individuals. But it is not the external peculiarities of this insect to which I wish to draw attention in this note so much as the peculiar radiate bodies in the *receptaculum seminis*, which, if they occur at all in other insects, are never found in anything like the remarkable development in which they exist in the species of the family Prodoxidæ. In the very first studies of *Pronuba yuccasella* these radiate bodies were noticeable, and have been referred to by me as being visible even through the sides of the body when this is rendered in any way transparent. They consist of a pair of brown, chitinous radiate structures, each with a darker central circular ring or hub. More closely studied this circular ring is seen to represent the end of a hollow though shallow cylinder, from the sides of which the spicules radiate. The individual spicules have an inner groove or channel running from the very tip to the base. I present some drawings which will indicate the relative size of the pear-shaped receptaculum in the three known species of Pronuba and in *Prodoxus decipiens;* also the relative dimensions of the radiate bodies. It will be seen that they are very much the largest in *Pronuba yuccasella*. In *Pronuba synthetica* they are next in size; in *maculata* next;

and in *Prodoxus decipiens* very much smaller. To be more explicit I reproduce from the article referred to the following descriptive details:

If we examine the internal anatomy, we find that the ovaries are large and pyriform, composed of four multilocular tubes gradually enlarging to the point of insertion in the oviducts and with the opposite extremity prolonged into a binding cord attached to the thorax. The oviducts are rather short. There are two large sebaceous glands and two smaller accessory glands, and a large copulatory pouch connected with the oviduct by a short tube or canal which opens close to the entrance of the ductus seminalis, this leading to the receptaculum seminis. This receptaculum is nearly as large as the bursa, pyriform, flattened dorso-ventrally when empty, but more rounded when filled with semen. Its chief characteristic, however, is a pair of curious brown radiate bodies, the rays or spicules springing from a central hub, which looks like the disc of a composite flower. These bodies are attached at opposite sides of the pyriform sac and are so large and conspicuous as to be readily seen through the walls of the abdomen when this is mounted in balsam. The hub is concave from the outside and convex from the interior, the disc presenting a granulated structure and the spicules radiating from its margin obliquely into the interior of the sac. Each spicule, when closely examined, is seen to have along its inner border a hollow groove running from the base to the extreme tip (Fig. 13 *d*). There are some seventy or more of the longer

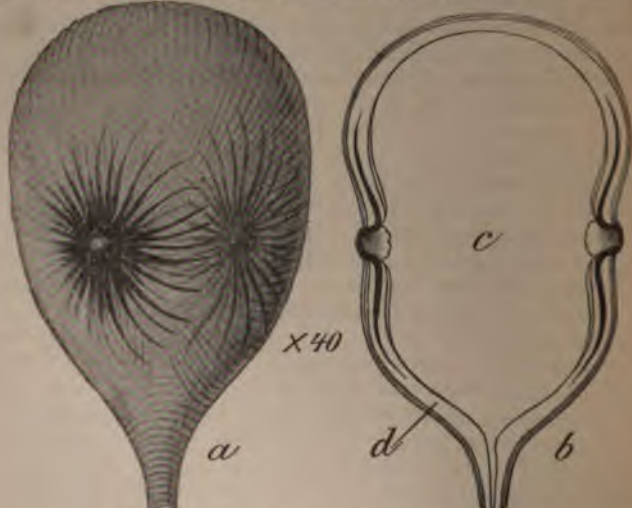


Fig. 13.—*a*, receptaculum seminis of *Pronuba yuccasella*, showing radiate bodies or crushers and muscular structure; *b*, same, longitudinal section through axle of hub, showing the main sac and the inner sac at *c* and the radiate bodies in the intervening space at *d* — × 40.

spicules and other shorter ones; but they vary less in length than in other species. In the impregnated female there is found within this receptaculum, and almost filling it, what appears to be an inner sac with a narrow neck entering and following the neck of the receptaculum. This is doubtless but a combined mass of spermatic particles or fasciculi forming what has been called by Lepidopterists the large spermatophore. The albumen-like wall or envelope of this mass is somewhat thickened as it approaches the hubs of the receptaculum but then suddenly becomes thin and is somewhat insecurely fastened to the hubs, so that when the spermatophore is detached there is practically an opening in each side at the point where it was attached to the receptaculum. There are three membranes to this receptaculum--an external or muscular, a middle or serous, and an internal or mucous. The strong fibres of the muscular coat radiate from the border of the hub of one of the chitinous bodies, and are inserted in a similar position upon that of the opposite side. They thus include the whole of the sac until toward the neck, where they change to circular constricting fibres, and thus continue through the duct. Fig. 13 *a* gives an enlarged view of this receptaculum, with a longitudinal section through the hubs at *b*, showing the large spermatophore or inner sac *c*, the space between it and the walls of the receptaculum, and the manner in which the hub and the radiate spicules are placed at *d*. In *Pronuba yuccasella* this receptaculum averages about 1.7 mm. in length, by 1 mm. in diameter, the crusher or radiate body measuring 1 mm., the rays averaging 0.43 mm. in length and the hub or axis 0.14 mm. in diameter. By way of exhibiting how very much more strongly developed this receptaculum and its crushers are in *yuccasella* than those in any other species, I have introduced (Fig. 14) drawings of the similar organs of *Pronuba synthetica* (*a*), *P. maculata*

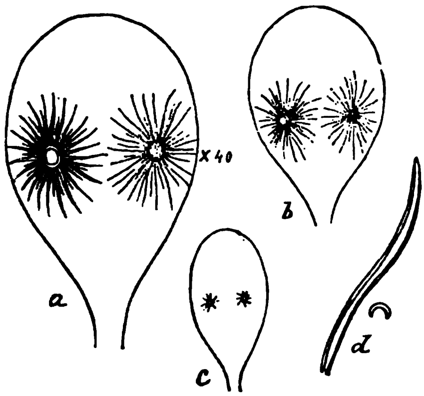


Fig. 14.—*a*, outline of receptaculum seminis of *Pronuba synthetica*; *b*, do. of *Pronuba maculata*; *c*, do. of *Prodoxus decipiens*, all drawn to same scale as figure 13; *d*, enlarged spicule showing ventral groove and a transverse section of same.

(*b*), and *Prodoxus decipiens* (*c*), drawn to the same scale. In *P. synthetica* the receptaculum averages about 1 mm. in length and 0 66 in width; the crusher has a diameter of 0.43 mm., the longer rays about 0.17 mm. in length, and the axis or hub about 0.10 mm. in diameter. The crusher in this species looks much more like a burr, there being 16 of the longer, 24 of a shorter size, 32 yet shorter, and a number of the shortest which graduate into the tubercular inner surface of the hub. In *P. maculata* the receptaculum has a length of 0.66 mm., and a diameter of 0.5 mm.; the crusher has a diameter of 0.4 mm., the longest rays a length of about 0.17 mm., and the axis a diameter of 0.06 mm. In *Prodoxus decipiens* the receptaculum has a length of 0.65 mm. and a diameter of 0.3 mm. The crusher measures 0.09 mm., with the longest rays 0.05 in length and axis 0.02 in diameter. The axis is relatively longer than in the other species, and the spicules are much reduced in number.

The object of these chitinous bodies has been somewhat of a puzzle, all the more difficult to solve that they seem to be quite exceptional, and, in the remarkable development which they here present, absolutely unique, so far as I have been able to ascertain. They attracted my attention in my earlier studies of Pronuba and I was glad to find, on visiting Dr. H. A. Hagen in 1880, that he had been very much interested, in his studies of Prodoxus, in the similar but smaller organs of that insect. His explanation of their function, as elaborated in the Zoologischer Anzeiger (Jan. 1882, pp. 18-21), is doubtless correct, viz., that they serve to liberate the spermatozoa from the spermatophores, but he was in error in locating them in the bursa instead of the receptaculum.* The muscular arrangement which I have described is well suited to such a purpose. In the somewhat flattened receptaculum the spicular arms actually intermingle, and the radiating muscular coat possesses the only arrangement of fibres which would enable a simple contraction to bring at once the whole con-

* In this paper Dr. Hagen elaborately describes these radiate bodies from both Pronuba and Prodoxus. Aside from the error of locating them in the *bursa* instead of the *receptaculum*, some of his other statements are very confusing in the light of the facts as observed by me. What he calls the inner sac (the large spermatophore) does not occur in the virgin but only in the impregnated female, and yet he describes it from what he insists were virgins, stating that "die drei ersten Schmetterlinge welche auskamen waren Weibchen: da ich sie untersuchte bevor einige Tage später Männchen erschienen, bin ich sicher das sie unbefruchtet waren." He then states that he found the empty space between the inner sac and the inner lining of the outer sac filled, after coition, with spermatophores clustering particularly about the star, while the inner sac and its outlet contained only the hair-like spermatozoa. I cannot explain the earlier statement except as another of the unfortunate errors my good friend has been led into in connection with the Yucca moths. It is so explicit, however, that, since this communication was presented, I have again examined virgin females of both Prodoxus and Pronuba, only to confirm the fact that there is no inner sac to the receptaculum, and that the presence of this sac or large spermatophore is a sure evidence of impregnation.

tents of the sac into the nest of pointed blades. At the same time an egress is afforded the liberated spermatozoa through the mouth of the duct—the only point not constricted by the radiating fibres—and once within its walls a successive contraction of its muscular fibres, like the vermicular action in the small intestines of mammals, would cause their ready descent to the oviduct. Thus the spicules not only serve to liberate the spermatozoa, but also to facilitate their egress through the attached base, where the spermatophore wall is thinnest.

2.—Pseudo-cenchri.

A feature which in *Pronuba synthetica* tends to add to its saw-fly resemblances is a pair of cenchri-like spots on the metathorax which are transversely ovoid and more or less iridescent and translucent, showing the more distinctly by their pale color as compared with the darker piceous coloring of the thorax itself. In denuding a number of specimens in other families of Lepidoptera to see how general these cenchri-like spots are, I have been led to some rather interesting observations. I find that they are noticeable in other species of the Tineina, but are easily overlooked because the vestiture generally hides them, and further because they are not ordinarily as specialized as in Pronuba. They are superficial and yet with a sufficiently differentiated structure to be quite noticeable, the surface being covered with transparent papillæ which easily rub off. The true cenchri of Hymenoptera seem to be little understood by writers, and, in fact, they have received comparatively little study as to their function. They vary in structure in the different families, so far as the few observations I have made justify a conclusion, but generally consist of a scale which forms a sort of lid to a cavity protected by a membrane and which indicates that they may be organs of sound rather than of any other sense. They occur on the metathorax immediately behind the scutellum in Tenthredinidæ and Uroceridæ, and are generally referred to as light-colored spots, or more minutely—as by André—as "two small symmetrical callosities, usually light and semi-transparent; rarely they are covered, as in Lyda, by a sort of scale or overlapping hood, and their function is not known." They are called granulæ by Thompson, and cenchri by most others.

A closer examination of their structure shows that they are always or very generally in the form of scales, which are free on the posterior end and side, and thus form a hood or projection over an opening into the body cavity. This opening, so far as can be determined in dried specimens, is protected by a delicate membrane.

The scale-like protection of the cenchri, as described from the species of Lyda, is inaccurate, for the scale is the cenchrus, which

in this genus projects or is raised at its free end noticeably from the general surface of the body. In other saw-flies and in Uroceridæ the scale is applied rather closely to the edges of this opening, and in Cimbex and other species fits into a depression so that careful dissection is necessary to show its true character. This scale is usually oval, but in Lyda (and less so in Uroceridæ) is more or less triangular. It is lighter colored than the rest of the body (less so in Uroceridæ and some species of Lyda), is nearly transparent, and is, so far as studied, hexagonally sculptured over its entire surface. It is much thinner than the chitinous wall of the body and generally membraneous. Beneath it is a large open space closed in whole or in part by a muscular band. As I have asked Mr. Marlatt to follow up the subject so far as the Hymenoptera are concerned, and to give us the results at some future meeting, I will not enter into further details in reference to that Order. I will simply add that in the Lepidoptera, in which I have examined the types of a good many families, the similarly placed but superficial spots are not specialized, but are mere inflations or modifications of the chitine wall. They are wanting in the Rhopalocera and in the higher groups of the Heterocera, while in the Tortricina and Tineina, in which they are usually well developed, they have remained unnoticed for the reasons stated above. They are, in fact, structurally quite distinct from the true cenchri of the Hymenoptera and recall them chiefly because of their similar position on the metathorax. Yet it is difficult to overcome the conclusion that the true cenchri of the Hymenoptera are, in some way, modifications of these simple structures in the Lepidoptera. The peculiar opalescence which they often show in the Lepidoptera is caused by the refraction of the light due to thickly placed chitinous papillæ, but so far as I have been able to see there is no modification of the chitine wall and no opening.

3.—The Tegulæ and the Patagia.

In denuding these different species of Lepidoptera of various families I was interested in noting the remarkable variation, and at times the great prominence, of the tegulæ, organs which are usually clothed with special hairs which form the shoulder lappets, and the actual chitinous structure of which is generally overlooked by lepidopterists. I exhibit certain specimens to show how these tegulæ when denuded form prominent tuberculous or scale-like projections, and are the more conspicuous by virtue of the different coloration from the rest of the thorax. The strangest thing about them, however, is that they have been con-[illegible] with the patagia. On the authority of [illegible] Kirby and Spence were the first to [illegible] appendages of the prothorax.

which they called patagia. Chrebrier was, however, the first to discover them, though he probably confounded them with the tegulæ. Burmeister entirely overlooks the presence of the patagial appendages of the prothorax, and asserts that the patagia of Kirby and Spence are identical with their tegulæ, which cover the base of the anterior wings (page 78), and his remark (page 77) that the patagia of Kirby and Spence, which they considered as appendages of the prothorax, are not set upon this but upon the mesothorax, indicates his entire failure to observe the true patagia of the prothorax. He adopts also the term patagia for the tegulæ. It seems that from this error a general confusion relating to these appendages has arisen, and a number of lepidopterists have followed Burmeister blindly in confounding the patagia with the true tegulæ, or rather in ignoring the former and applying the term patagia to the tegulæ proper, and this, in spite of the fact that Kirby and Spence had clearly defined the two structures and figured them, and that Westwood had later called attention to the very confusion which lepidopterists had before made and have since continued. Thus Packard in his "Guide" does not describe the patagia, but uses the term for the tegulæ. Minot & Burgess (Fourth Rep. U. S. E. C.) call the true patagia two pendulous lobes which project from the upper sides of the prothorax, the real homology of which is said not to be determined. They follow Packard in calling the tegulæ patagia. J. B. Smith has, in his writings, so far as I can find, omitted all mention of these organs. Mr. C. H. French, in his Butterflies of the Eastern U. S., simply says: "The only appendages of the prothorax are a series of scales arising from the upper side, forming a collar, and on each side a small scaly piece covering the base of the forewings and known as the shoulder tuft, lappet, or pterygoid." He evidently refers here to the tegulæ, which are not attached to the prothorax as stated. W. F. Kirby, in the chapter on butterflies, etc., in Cassell's Natural History, refers to the tegulæ as the scapulæ, and does not mention the patagia. The same author, in his European Butterflies and Moths, does not refer specifically to these parts, but mentions a tuft of scales on the thorax behind the collar. J. H. Comstock uses the term "paraptera" for tegulæ, and calls attention to the various terms that have been used for these "leaf-like epaulets," remarking that in the Lepidoptera they are very large and are usually termed patagia. He falls into the same error as Packard and Minot, and seems to overlook the true patagia on the prothorax. Scudder follows Minot and calls the patagia in butterflies the "prothoracic lobes." The original definitions by Westwood and Kirby and Spence should evidently be our guides in the nomenclature of these parts, viz:

Patagia, concavo-convex scales covered with hairs on the upper side of the prothorax.

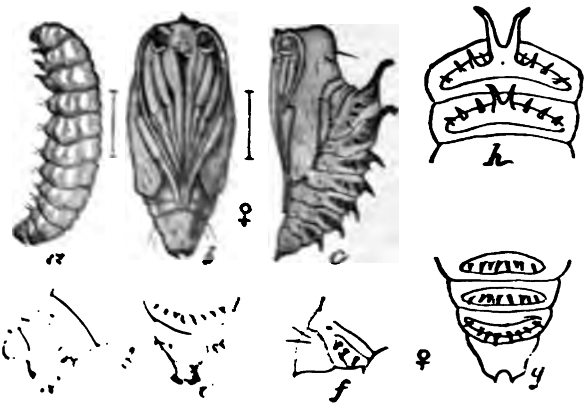
Tegulæ (pterogodes of Latreille; paraptera of McLeay; scapulæ of other authors), the triangular scales covering the base of the primaries.

NEW SPECIES OF PRODOXIDÆ.

By C. V. Riley.

Upon my return from California in 1887 I gave some account before the Society of the insects associated with *Yucca brevifolia*, the tree yucca of the Mojave Desert, and exhibited specimens of the Pronuba, which I found to be associated with the flower of the yucca as its pollenizer. I called attention to its peculiarities and suggested that I would describe it by the specific name of *paradoxa*. Pressure of other work has, up to the present time, prevented my doing so, but in connection with an article which I have recently prepared for the Annual Report of the Missouri Botanical Garden I have characterized the different species of Prodoxidæ. As that publication is not purely entomological in character, I have decided to present the descriptions of the new species to this society for publication.

Pronuba synthetica.—Larva (Fig. 15, *a*).—Length when full-grown, 14 mm. Somewhat more cylindrical than that of *yuccasella*, the general color being bluish-green tinted with a rosaceous hue; otherwise undistinguishable from those of the other two species.



[illegible] *a*, larva from side: *b*, ♀ chrysalis, ven[illegible] hair line: *d*, lateral, *e* dorsal [illegible] *h*, dorsal view of 2d and 3d joints [illegible]

CHRYSALIS (Fig. 15, *b*, *c*).—In size, general shape and arrangement of the spines similar to that of *yuccasella*, but readily distinguished by the wing-sheaths in both sexes reaching only to the sixth abdominal joint and tha posterior legs to the seventh, whereas in *yuccasella* the former reach to the eighth and the latter to about the middle of the ninth. The medio-dorsal spines are also longer, more prong-like and less spatulate, while the capitate spine is perhaps less prominent. The difference is more particularly noticeable in the greater length and prominence of the two spines on the second abdominal joint. The anal joint in the male is narrower and comparatively longer, and the two terminal teeth much shorter than in the female, also not so well defined as in *yuccasella*. The anal segment in the female is broader and stouter than in *yuccasella*, with the teeth shorter, stouter and further apart. (*c*, *d*, *e*, *f*, *g*, *h*.)

IMAGO (Fig. 16, *a*).—Expanse ♀, 15–20 mm.; ♂, 16–18 mm. Body flattened, piceous. Wings smoky-gray; the scales sparse and as easily lost on the upper surface, especially of primaries, as in the Sesildæ, so

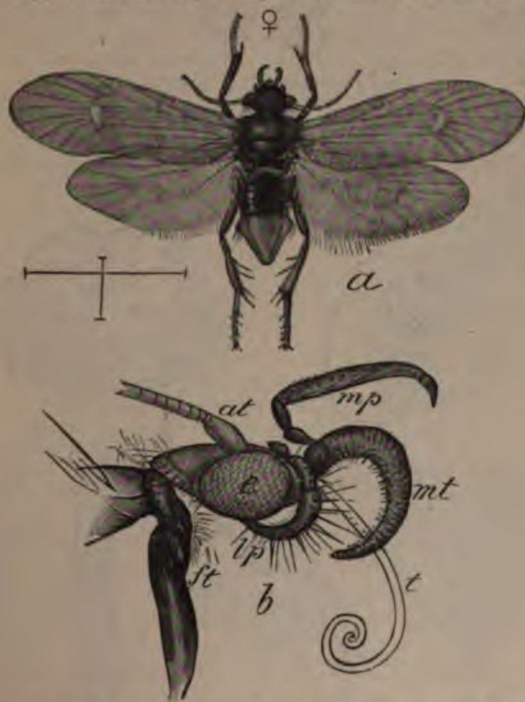


Fig. 16.—*Pronuba synthetica*: *a*, ♀ with wings expanded, hair-line showing nat. size; *b*, lateral view of the head and neck, more enlarged, showing a purely lateral view of the trophi not in pairs to avoid confusion, the maxillary palpus (*mp*) with its tentacle (*mt*); tongue (*t*); labial palpus (*lp*); base of antenna (*at*); eye (*e*); front trochanter (*ft*).

that none but those carefully killed soon after issuing from the chrysalis show the wings well covered. In such specimens the general color is cinereous, the primaries but slightly darker than secondaries, the scales being narrow and elongate: mostly gray, but with an admixture of black ones. The exposed membrane of the wing is fuliginous except a narrow discal space and more or less of the costal region which remain sordid white. Fringes paler but sparse and easily lost except at anal angle of hind wings, where they persist. Veins black and strong. Body but sparsely clothed in freshest specimens and soon becoming bare except at neck; highly polished and minutely punctate, and in some specimens with metallic tendency. *Head* (Fig. 16, *b*) with the hair pale ferruginous; eyes brown, naked; labial palpi brownish-black with sparse white scales; maxillary tentacles stout and brown, shorter than tongue: max. palpi nearly as long as tentacle, basal joint stout, rounded, joints 2 and 3 short, subequal in length, joint 4 very long, terminal joint with two spines at tip; tongue very stout, long and ferruginous; antennæ black. *Thorax* with two angular transverse-ovid translucent and somewhat opalescent spots recalling the so-called cenchri of Tenthredinids; legs stout and dark, the hind tibiæ and tarsi pale ferruginous. *Abdomen* separated from thorax dorsally by a broad and deep suture which is pale rufous by contrast with the general piceous color; anal joint (Fig. 17, *b*, *c*, *d*) in ♀ rufous, with darker shade at base, the sides compressed from above and expanded into a broad and angulate wing, the borders of which are thickened and stiff-

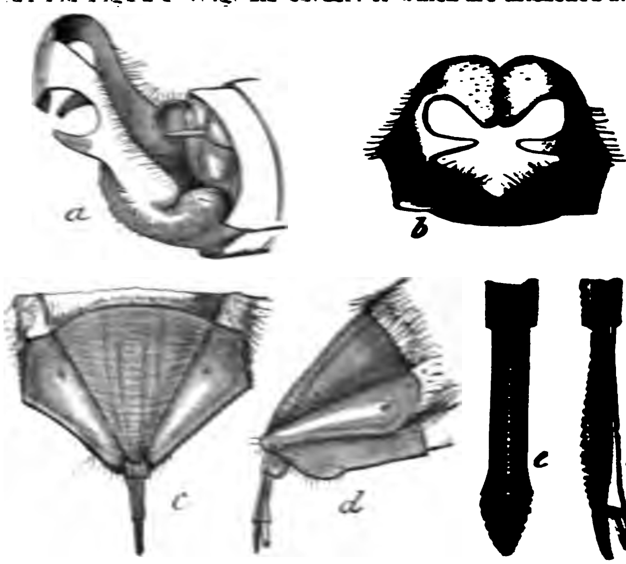


Fig. 17.—[illegible] enlarged view genitalia of ♂ from side: [illegible] ovipositor exserted, dorsal view; [illegible] lateral view [illegible] dorsal view, still more enlarged; [illegible] from side.

ened and converge to a rather sharp tip which is, however, obliquely truncate from the side: ovipositor issuing generally at right angles and with the same parts as in *yuccasella* but all stouter and shorter (*e*, *f*). In the ♂ the dorsal fulvous suture or pit between thorax and abdomen is more profound and concave, the abdomen is less flattened and the claspers are brown, very stout, one-half as long as the abdomen, the basal part broad and leaf-like, the terminal part abruptly curved upward, dilated into a decurved triangular tip, and the prong quite long, slightly curved and denticulate at tip. (*a*, *b*.)

Described from 28 ♀'s, 10 ♂'s from *Yucca brevifolia*.

This is the third species of Pronuba so far known, *P. yuccasella* pollenizing and breeding in the fruit of the different Yuccas growing within the United States east of the Rocky Mountains and showing a remarkable uniformity in coloration; *Pronuba*

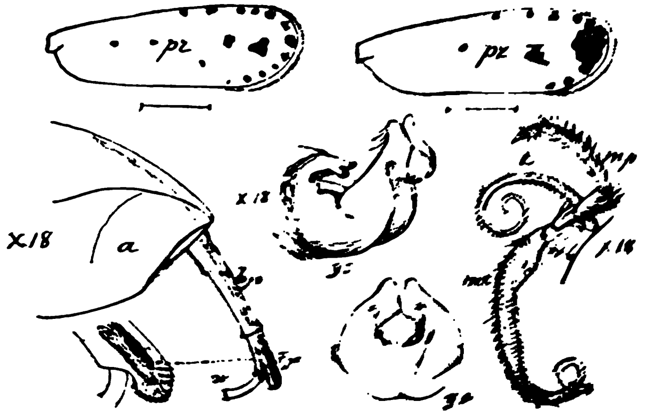


Fig. 18.—*Pronuba maculata*: *a*, [illegible] of female abdomen [illegible] ovipositor; *tjo*, terminal joint [illegible] maxillary tentacle; *t*, tongue; *gs*, [illegible] from behind; *pr*, front wings showing arrangement of [illegible] the more common forms—hair line showing [illegible].

maculata (Fig. 18) affecting in a similar way [illegible] of California, and showing very great variation in the [illegible]tion of the wings. This [illegible] of the Lepidoptera, as it is the only [illegible] has become so altered as to be [illegible] the two parts being very easily [illegible] their length with dense hair.

Prodoxus pulverulentus, [illegible] eral color, white: head with the antennæ [illegible]

eyes brown; palpi pale yellowish, hairs white. *Thorax*, with the hair mixed with a few blackish scales; primaries white, more or less densely sprinkled with blackish scales at the posterior third, and sparsely so on the remaining portion. These dark scales produce a powdery appearance of the wings, the amount varying in the specimens before me, there being in two of them but a faint trace of the darker scales; secondaries white, with a broad dusky anterior margin; undersurfaces more densely flecked with blackish scales and hence somewhat darker. *Abdomen* fuscous above, with a few long whitish hairs on the terminal two joints; venter and legs white. Tip of the abdomen shaped as in *P. marginatus*.

I have five specimens of this species, all females, two of them reared from the seed-pods of *Yucca whipplei* in May, 1886, by Mr. Koebele, the pods obtained at Santiago, California, while three specimens were given me by President H. W. Harkness and Mary K. Curran, of the California Academy of Science, in April, 1887, and obtained from the flowers of the same Yucca. The adolescent states are still unknown.

Prodoxus y-inversus, n. sp.—IMAGO ♀.—Fig. 19.—Average expanse, 14 mm.; ♂, 10–12 mm. General color white. Head, thorax, legs, and abdomen white beneath, the hairs between the antennæ occasionally yellowish. Eyes black; palpi white; tip of labials yellowish; tongue pale yellowish. Primaries marked with black as follows—a costal streak

Fig. 19.—*Prodoxus y-inversus*: *a*, left front wing—hair-line underneath showing natural size; *b*, genitalia of male, dorsal view—×14; *c*, do., lateral view—×18; *d*, anal joint of female, with ovipositor exserted, lateral view—×20; *e*, tip of ovipositor still further enlarged.

along the basal half, widening somewhat posteriorly and more or less completely fused, with a round spot near its end. An elliptical or roundish spot about the middle of the wing at the basal third; a more or less sharply defined inverted-Y-shaped band across the posterior third of the wing, with its exterior arm generally connected posteriorly with a black patch which extends along the posterior border but is more or less broken at the extreme border, and also along its inner margin. This

terminal dark patch usually broadens toward the apex and is sharply cut off on the costa at about the outer fourth of the wing. Secondaries pale yellowish, darkest at apex; fringes concolorous. Undersurfaces with the dark markings of the primaries less sharply defined. *Abdomen*, brownish above, the male claspers (Fig. 19, *b*, *c*), yellowish-brown, almost bare, quite slender, and gradually narrowing toward the tip, which is almost acute; each arm is provided with 5 or 6 very small, cylindrical, acute teeth at the posterior edge; basal lobes are almost circular and concave at the inner side; upper basal plate triangular. Anal segment of the female obliquely truncate from above, but slightly so beneath, the ovipositor stout, yellowish-brown, its terminal part slender, compressed laterally, the upper edge of the apex being finely and acutely serrate. (Fig. 5, *d*, *e*.)

Described from four males and seven females, no two of which are exactly alike in the marginal details of the inverse Y-shaped band nor in those of the terminal patch.

Specimens of both sexes of this species were reared from parts of a pod of an unknown species of Yucca (but doubtless *Y. baccata*) received from Mr. D. C. Chapman, of Washington, D. C., who had obtained them in May, 1883, from New Mexico, the moths issuing during May of the following year. The larvæ infest the fleshy portions of the pod and produce hard, gall-like swellings. The cocoon, which, as with the other species, is constructed within the burrow, is pale brownish, and resembles an elongate, cylindrical bag, rounded at the base and cylindrical at the apex. When ready to transform, the larva retires to the lower third of the bag and separates it from the upper two-thirds by a dense, tough, delicate whitish layer of silk, thus dividing the cocoon into two unequal chambers. No larvæ were preserved, but those which were noticed in cutting open the swellings showed a remarkable resemblance to those of *decipiens*. The chrysalis also has not been studied.

Prodoxus reticulatus, n. sp.—IMAGO.—♀. Expanse, 10-11 mm. (Fig. 20). General color, white. Body with whitish hairs, those of the head inclining to yellowish, intermixed with a few darker hairs, especially

Fig. 20.—*Prodoxus reticulatus:* female with wings expanded—hair-line showing natural size.

around the antennæ; the terminal joint of the palpi pale fuscous; vestiture of the legs superiorly dusky, with a slight cupreous reflection. Primaries with transverse blackish bands as follows: An oblique basal band much constricted at middle so that costal half is usually triangular; a narrow band along the posterior border and the intervening space between these two bands occupied by a broad W-shaped band, the outer arms of the letter running parallel with the basal and terminal bands. Fringes white. Secondaries gray; fringes somewhat darker. Undersurfaces gray, with a brassy reflection, the darker markings of the primaries being but faintly indicated. *Abdomen* with the anal joint perpendicularly truncate, the flexible basal part of the ovipositor rather broad at base and pale, while the terminal part is stout, sharp, and brownish in color.

I have but three females of this species, taken by Mr. Koebele in March at Los Angeles, California, but without any notes of habit.

Prodoxus coloradensis, n. sp.—IMAGO.—♂. Expanse, 11 mm. (Fig. 21). General color, white and somewhat glossy, the hair of the head being faintly yellowish between the antennæ. Eyes black; antennæ white at basal third, the rest fuscous; palpi and tongue pale yellow. A

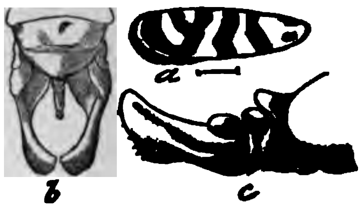


Fig. 21.—*Prodoxus coloradensis*: *a*, left front wing—hair-line underneath showing natural size; *b*, male genitalia, dorsal view —×15; *c*, do., lateral view—×18.

few hairs on the maxillary palpi and the extreme tip blackish. Primaries (Fig. 6, *a*) with a well-defined band starting at right angles from costa to basal third and then obliquing suddenly though slightly toward base; a somewhat similar band across the middle of the wing obliquing first in the opposite direction, *i. e.*, posteriorly, and then almost parallel with the first band; and a forked or somewhat Y-shaped band across the posterior third of wing; a terminal black border connects with this Y-mark at anal angle but not at apex, and there is more or less black at base of wing. Secondaries whitish above; fringes white. Undersurfaces faintly dusky with a slight æneus reflection and the markings of the primaries less defined than above, and the secondaries somewhat dusky toward the apex. Abdomen brownish with the scales also brownish, especially along the sides, but white beneath. Claspers pale brown, covered with long

yellowish hairs and almost identical in form with those of *y-inversus* (Fig. 7, *b*, *c*).

Of this species I have seen but a single male, taken in 1884, by Mr. Morrison, in Colorado. In general appearance, as well as in the genital characters, it seems to be quite closely related to *P. y-inversus*.

Prodoxus sordidus, n. sp.—IMAGO.—♂. Expanse, 8-10 mm.; ♀, 11-13 mm. General color, creamy-yellow, the females showing the most white. A more or less distinct dusky or blackish posterior margin to the secondaries, the dark color broadening toward the apex. The undersurfaces have a tendency to metallic reflection and the darker color of the hind border of the secondaries is repeated. Abdomen grayish-brown dorsally, with iridescent reflection. Anal segment of ♀ reddish-brown, obliquely truncate from above, the tip rounded. Ovipositor yellowish-brown, slender and finely denticulate along the upper edge. Male claspers similar in shape to those of *decipiens* but more slender, the base comparatively broader and the apex more abruptly rounded; the basal side piece narrower and pointed at tip; the posterior edge with from 3 to 5 small slender teeth.

Described from 5 males and 5 females.

I first found this species in the flowers of *Yucca brevifolia* on the same occasion of the discovery of *Pronuba synthetica*, while other specimens were subsequently obtained by Mr. Koebele. In general appearance the species seems nearest related to *P. cinereus*, being, how ver, much paler, with the greater portion of the hind wings w ite.

COLEOPTEROUS LARVÆ WITH SO-CALLED DORSAL PROLEGS.

By C. V. Riley.

I have recently received from Mr. D. W. Coquillett, of Los Angeles, California, the larva of *Mordellistena pustulata*, which he found in the dry stalks, apparently of the previous year's growth, of *Xanthium strumarium*, and as they exhibit a peculiarity, viz., the possession of dorsal fleshy processes having the appearance of prolegs which belongs generally to the larvæ of this genus, I have thought it well to exhibit them to the Society, as also some other larvæ which possess similar characteristics. Many of the members will remember that at the 1890 (Indianapolis) meeting of the A. A. A. S., at which I was not present, Prof. H. Osborn read a note (published in the *Canadian Entomologist*, Vol. XXII, 1890, pp.

217–218), on a peculiar form of Coleopterous larva in which a striking peculiarity is mentioned in two larvæ, one found boring in the pith of a small ash twig, and the other in the stems of Helianthus. He was unable to breed the perfect insects or to identify the larvæ. The peculiarity of these two larvæ as described by Prof. Osborn was "a pair of prolegs similar to those often found on many caterpillars, but, strange to say, these are arranged on the dorsal surface" of the first six abdominal segments. It is more than probable that the specimen from Helianthus which Prof. Osborn stated to have a striking resemblance to a Languria larva was a larva of Mordellistena. That from ash twigs may also possibly belong to the same genus or even to some species of Cerambycid, especially of the groups Saperdini or Phytœciini. These "dorsal prolegs" have been described and figured by Edouard Perris in his *Larves de Coleoptères* in *Mordellistena pumila* and *M. perrisii* (pp. 331–335, Plate IX, Fig. 359) and in Cerambycids of various species—Saperda, Agapanthia, Phytœcia, etc (pp. 495–514, Plate XIII, Fig. 518). They are described by Perris as *ampoules ambulatoires*, which are greatly prominent, retractile, and divided into two lobes by a median depression, beset with little hairs, and covered with extremely minute spiniform setæ.

Similar organs are also very well developed in the genera Nacerdes and Asclera of the family Œdemeridæ as described and figured by Schiödte (Naturh. Tidskr. 12, 1883, pp. 540–546, tab. XVI, Figs. 2 and 12). The larvæ of both genera resemble each other greatly, and, when viewed from the side, are provided with 6 abruptly prominent "dorsal legs," one on each of the thoracic segments and one on each of the first three abdominal segments. When viewed from above each of these ambulatorial tubercles is seen to be divided into two "areæ scansoriæ" by a deep sulcus. In addition to these organs, and in addition to the well-developed though rather short, regular legs, these larvæ have ventral false legs greatly resembling those of Lepidopterous larvæ. In Asclera there are three pairs of such ventral legs, one on each of the first three abdominal segments, while in Nacerdes there are only two pairs situated on the third and fourth abdominal segment. Both larvæ are known to live in decaying wood.

In the same stalks in which Mr. Coquillett found his larva of *Mordellistena pustulata* he also found the legless larva of a Curculionid beetle, *Copturus adspersus*, and the 16-legged larva of a species of Pædisca belonging to the Tortricina. He conjectured that the Mordellistena larva was carnivorous, and proved it by finding that it fed upon the Pædisca larva, the empty skins of which he had frequently found in the very stems inhabited by the Mordellistena. The fact that Prof. Osborn found that one of his larvæ fed voraciously upon Dipterous larvæ found in the same

stems would confirm the carnivorous habit of at least some of the species of this genus in the larva state.

It is an interesting fact, however, in this connection, that all the larvæ of Mordellistena have not the carnivorous habit nor the dorsal tubercles so prominently developed, and I exhibit samples of four other species by way of illustration. In *Mordellistena unicolor* which I found July 13, 1874, in the stems of *Ambrosia artemisiæfolia*. and which was subsequently obtained by Mr. H. G. Hubbard from the stems of an undetermined plant at Detroit, Michigan, the dorsal tubercles are somewhat less developed than in those of *pustulata*, but still quite prominent.

A single larva from the stems of the tall grass *Triodia cuprea* was found April 8, 1888, the larva commencing work near the flower and gradually working down to the roots. At from one to two inches above the ground the stem is almost cut through so that it is frequently broken off by the wind. August 9th the perfect beetle issued and Chalcidid parasites were also bred from the same stem. The species appears to be *M. nubila* Lec.; but the species of the genus are difficult to determine, and Prof. J. B. Smith's paper has not helped to make the determinations easier. This larva has the tubercles least developed, but they are faintly discernible on the same joints as in the other species. This larva also differs from the others in the more rudimentary thoracic legs and comes much nearer in characteristics to the typical larva of Mordella.

A single larva, without number, from the stems of Amarantus also shows the dorsal tubercles but faintly developed.

In *Mordellistena floridensis* (Fig. 22), of which I exhibit good

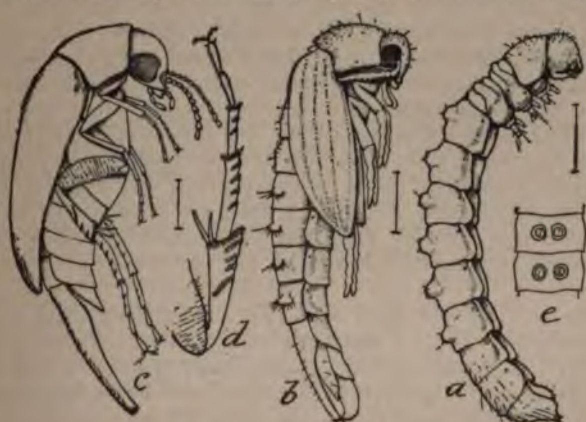


Fig. 22.—*Mordellistena floridensis*: *a*, larva; *b*, pupa; *c*, imago; *d*, hind leg of same; *e*, dorsal tubercles of larva seen from above (original).

biologic material, viz., 3 larvæ, 3 pupæ, and 2 bred adults, the dorsal tubercles are quite distinct on the first six abdominal joints. The larva was taken in the stems of *Uniola paniculata* by Mr. Schwarz at Lake Worth, Fla., in June, 1887, and he has referred to it in his paper in our Proceedings (Vol. I, No. 2, pp. 106–7) on insects found on *Uniola paniculata* in southeastern Florida, without particularly referring to the tubercles, and under the name *M. splendens*. Mr. Schwarz tells me that there can be no doubt as to its phytophagic habit.

Perris has remarked that the larvæ with ambulatorial tubercles preferably inhabit the stems of such annual plants as are hollow, as for instance grasses, and further that they always live singly, in contradistinction to the larvæ without such tubercles, which live always in company and affect more pithy plants without natural channels, and do not hollow out long open galleries. This is a perfectly legitimate inference, as these tubercles facilitate climbing in hollow stems and permit the larva to rapidly move about and ascend or descend in the burrows; but I suspect that another deduction is justifiable from the facts, namely, that the tubercles will be found most strongly developed in Mordellistena larvæ which are essentially carnivorous and which, as a consequence, do not make burrows themselves, but are well-fitted for using the burrows made by their victim and of thus moving freely about in them.

In general characteristics the larva of Mordellistena resembles somewhat that of Mordella. The body is, however, more curved, the thoracic legs longer, and the anal spinose tip more slender and less developed, so that the Mordella larva makes up for its lack of dorsal tubercles by the much stouter anal segment and the stouter spines connected with it. I have figured the early stages of *Mordella 8-punctata* in Le Baron's 4th Report on the Noxious and Beneficial Insects of Illinois, Figure 50, and I exhibit the original specimens of this species, and also the larva and pupa of *Mordella inflammata*, reared by Mr. Hubbard in Florida, and taken from rotten oak logs. In the pupa of Mordellistena the dorsal tubercles of the larva on the 3d, 4th, 5th, and 6th abdominal joints persist, and are, in fact, more strongly hirsute at tip, the development increasing from the 3d to the 6th, and in the pupa of Mordella there are some similar but less marked hirsute lateral tubercles.

I also exhibit old drawings (Fig. 23) taken from my early notes, made in 1867, of the larva and pupa of *Oberea schaumii* (my No. 118) reared, with a transcription from the notes showing that the larva was found in May and June, 1867, in the branches of small cottonwoods in North Chicago. The figures in the notes indicate the very deep insections and the tubercular or ridged appearance of the segments, especially on the dorsum. This char-

acter is also well shown in an unbred larva of Oberea from apple twigs, which is also exhibited. The development of these dorsal ridges or tubercles in the Cerambycid larvæ, so as to become aids

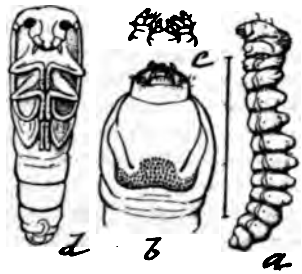


FIG. 23.—Oberea schaumii: *a*, larva; *b*, head of larva from above; *c*, labium and maxillæ of larva; *d*, pupa (original).

to locomotion, within hollow stems or burrows, is easily understood, because the larvæ of the whole family are characterized by having a series of dorsal plates more or less distinctly armed with hairs or spines and medio-dorsally divided, which aid in the movements within their burrows. It is evidently incorrect to call these abnormally developed tubercles prolegs, as they have none of the structures which distinguish the true prolegs from the various bulgings or tubercles which occur, whether ventrally, laterally, or dorsally, in sundry Coleopterous larvæ, and which, in some cases, as I have shown in the larva of Colaspis, become specialized appendages.

[*Transcript from Note-book.*]

NO. 118—CERAMBYCID LARVA IN COTTONWOOD STEMS (*Oberea schaumii* Lec.)

Found May 26th, 1867. Length 0.76. Color deep butter-yellow. Head slightly darker and jaws and mouth-parts black. Stigmata brown. Perfectly cylindrical and of the same diameter throughout, with the exception of first and last segments. Insections broad and deep. Head and mouth-parts protrude considerably forward and are characteristic. Makes a very smooth, cylindrical burrow, straight and lengthwise of the limb, the castings being of a deep reddish brown. Found in branches of small cottonwoods on north side of the city (Chicago).

June 6th.—Found more of them to-day, mostly in the pupa state. They probably live two years in the tree, as I found two sizes, the smaller measuring about .33 inch, otherwise being the exact counterpart of the mature worm. At the entrance where the larva was first hatched a rough, knotty incision is always found, and during the first year of its growth the larva does not enter the centre of the tree, but keeps on one side. just within the

sap-wood. Its burrow is at this time kept clean, with but a few grains of *white* excrement clinging to the sides, though afterwards it fills it full of brown excrement, or at least it becomes brown by the moisture. The white, chip-like pieces which I supposed to be pieces of the wood plucked off and the nutriment sucked out of them are really excrement, as I saw it passing from the larva. The pupa is of the usual color and is well represented in figure accompanying, its principal characteristic feature being the manner in which the antennæ are curled around the legs.

June 15th.—Difficult to breed to the imago, and, after losing dozens, with the best of care, I was rewarded at last with a single perfect specimen. It is the *Oberea schaumii.*

March 15th, 1868.—I found larvæ still in the trees, and that they live in the tree two years is more than ever evident from the fact that there are always two sizes.

Nov. 12th, 1871.—Find a larva indistinguishable boring the stem of *Salix longifolia.*

In discussing the note on tegulæ and patagia, Mr. Howard said that he had correctly defined these terms in the Century Dictionary, giving the Kirby and Spence signification to the word patagium as a pronotal sclerite. He also said that Comstock could hardly be said to have fallen into error in reference to these sclerites, since he correctly defines the tegulæ and simply adds (what is certainly true) that in descriptive works by lepidopterists these structures are called patagia.

Mr. Schwarz gave the reason why he was led to refer the Mordellistena from the stems of *Uniola paniculata* to *M. splendens* instead of *M. floridensis*. He stated that he had experienced some trouble in getting at the name of this species. By a clerical or typographical error in the table of Mr. J. B. Smith's synopsis of Mordellidæ no structural differences (number of tarsal ridges) were given between *M. splendens* and *M. floridensis*, but he found that the species from *Uniola paniculata* agreed perfectly with the type specimen of *M. splendens* in the Smith collection now preserved at the National Museum. Subsequently, however, he was informed by Dr. Horn that the second typical specimen of *M. splendens* in the Le Conte cabinet was specifically different from the Floridian species, and that the latter had to be referred to *M. floridensis*. Mr. Schwarz added that upon examination of many specimens of this Mordellistena he found that there was considerable variation in the number and extent of the ridges on

the hind tibia and first tarsal joint, and that in his opinion too **much** reliance had been placed on this character for the distinc**tion** of species.

Mr. Doran read a paper entitled:

THE EVOLUTION OF HEAT BY SILVANUS CASSIÆ

By E. W. DORAN.

February 20, 1892, my attention was called to a bin of [illegible] middlings, used for feeding stock at the barn of the [illegible] Agricultural College, which was badly infested [illegible] mon red beetle often found in stored gra[illegible] material I perceived at once that [illegible] an accurate thermometer, I made the [illegible] Time of day, [illegible] P. M.; temperature [illegible] temperature [illegible] middlings, [illegible] place, [illegible] F. [illegible] two points, [illegible] F. [illegible] places where [illegible] ture were [illegible] in the same [illegible] apart, and at about the same distance [illegible] extremely high temperature was [illegible] more than two or three feet in diameter [illegible] were very numerous, as well as the [illegible] perfect[illegible] with no indications [illegible] lower temperature of [illegible] F. or near [illegible] places in the same bin, and in other [illegible] the same room.

Five days later, February [illegible] with the following observations: Time [illegible] ture of the room, [illegible] F.; highest temperat[illegible] [illegible] F.; lowest temperature [illegible] between the two extremes, [illegible] F. [illegible] points one foot apart, [illegible] F.

The difference between the result[illegible] vation is due to the fact that the material [illegible] stirred up in making the examination [illegible] of feeding experiments. However, [illegible] fall in temperature [illegible] only [illegible] the extremes [illegible] F. less.

Another examination [illegible] week after [illegible] grees difference, which may have been [illegible] ring of the material.

At first, as I have said, the [illegible] small place, though the [illegible]

The highest temperature was found about $1\frac{1}{2}$ or 2 feet below the surface. Within this area the beetles were very numerous. By weighing a quantity of the middlings, and counting the beetles taken therefrom, I found about fifteen hundred beetles to a pound of the middlings. I found 103 from a single ounce, which would make 1,648 to the pound. But the beetles are very small; a hundred weighed only 23 grains. Hence to the pound of the material there would be about 345 or 350 grains of beetles, or about $\frac{1}{20}$ of the whole weight.

As the middlings are fed to hogs chiefly, this large percentage of animal food will likely produce no serious results, though it might affect the more sensitive palate of the cow.

There are, so far as I know, but three other records in regard to the production of heat in grain by insects. Two of these refer to the work of *Bruchus scutellaris* in pease. The first reference to the subject was by Judge Lawrence Johnson, recorded by Mr. L. O. Howard in *Insect Life*, Vol I, page 59. He found the temperature of the pease 25° F. above that of the atmosphere of the room. The second observation was by Mr. William D. Richardson, of Fredericksburg, Va., August 13, 1891, published in *Insect Life*, Vol. IV., page 16, issued November. 1891. Mr. Richardson found the temperature of the infested pease 18° F. above that of the atmosphere. This temperature continued two weeks, when it began to fall, the beetles soon after ceasing to emerge.

Prof. A. J. Cook* states that this beetle has been known to produce heat in grain, but gives no temperature record.

I am therefore enabled to put on record a rise in temperature caused by insects, more than double that observed by Judge Johnson, and lacking but 1° F. of being three times as great as that observed by Mr. Richardson.

The interesting question now remains, What caused the heat? In the case of *Bruchus* in pease it has been thought due entirely to the mechanical action, or friction, of the beetles in gnawing their way out of the pease, and this seems probable from the fact that when the beetles ceased to emerge the temperature fell; but with *Silvanus* in bran or middlings there is no gnawing-out process. The larvæ pupate in the loose material. It seems hardly probable that their crawling through or feeding upon the loose particles could produce so much heat. In order to test this, I allowed some beetles to fast one or two days; I then placed the bulb of a chemical thermometer in a tube, and filled it about an inch deep with beetles, which struggled and wriggled vigorously, but they had no appreciable effect upon the mercury. After several hours, I put in a quantity of the bran, and though the beetles

*Rept. Mich. Board of Agr. for 1889, p. 150.

ate very hoggishly they still produced no rise in the temperature. Another thermometer was kept in a tube a few inches away for constant comparison.

By watching some of the hungry beetles feed under the microscope, I found they ate only the fine flour-like particles, rooting aside the coarser particles of bran. Possibly, if a gallon or two of beetles had been tested in this way instead of one or two hundred, so that the loss of heat by radiation would not have been so great, a different result might have been obtained. It is well known that the crowding together of bees in the hive will produce a certain amount of heat, but certainly nothing like this extreme has been recorded, and it seems incredible that these little beetles could produce so much heat in this way. I have, however, recently found a high degree of heat produced—certainly 30 or 40° above the surrounding atmosphere—by an immense number of maggots in a barrel partly filled with refuse material from a slaughter-house on the Agricultural College farm. These were just completing their larval stage. From the fact that in every case the temperature was highest just about the time the change of stage occurred (from pupa to imago, or larva to pupa), it would be interesting to observe whether during this process of changing, or in ordinary moulting, insects commonly produce an abnormal amount of heat. I think we may expect to find that during the change in the insect a certain amount of so-called latent heat is changed into sensible heat, or a certain amount of heat energy is expended in the operation. This seems especially probable owing to the more or less complete histolysis during the pupa stage.

Discussed by Messrs. Marlatt, Austin, and Schwarz. Mr. Marlatt thought that the heat was partly produced by fermentation. Mr. Austin said he thought that it was due to the chemical action of the fæces setting up the fermentation with the meal. Mr. Schwarz said that the accumulation in numbers of insects produced considerable heat, and referred to the hibernation in crowds of *Megilla maculata*.

MAY 4TH, 1892.

President Riley in the chair. Nineteen persons present.

In the absence of the Recording Secretary, Mr. Marlatt was appointed Secretary *pro tempore*.

Prof. H. E. Summers, of Champaign, Ill., was elected a corresponding member.

In accordance with a formal announcement made at the preceding meeting, Article 6 of the Constitution was amended to read as follows:

ARTICLE VI.

The regular meetings of the Society shall be held, unless otherwise ordered, on the first Thursday of each month. The annual meeting for the election of officers and the delivery of the presidential address shall be the regular meeting for the month of December. The terms of office shall begin January 1st. Special and field meetings may be called by the Executive Committee.

The first paper of the evening was by Mr. Ashmead, entitled:

NOTES ON THE GENUS ENICOCEPHALUS WESTWOOD, AND DESCRIPTION OF A NEW SPECIES FROM UTAH.

By WM. H. ASHMEAD.

In the Transactions of the Entomological Society of London. Vol. II (1837), p. 22, Prof. J. O. Westwood described a new and remarkable heteropterous genus, *Enicocephalus*, which has subsequently been overlooked by hemipterists.

Dr. Carl Stal does not mention it in his Enumeratio Hemipterorum, published in 1872, in which the genera of the *Reduviidæ*, the family to which the genus belongs, are tabulated, nor does Prof. Philip Uhler include it in his "Check List" of the Hemiptera of North America, published in 1886, which includes the fauna of the West Indies, so that I am constrained to believe the genus was overlooked by these authorities.

In the publication referred to, Westwood very fully characterized the genus and described four species as follows:

(1) *Enicocephalus flavicollis*, from St. Vincent, W. I.
(2) *Enicocephalus basalis*, from Gum animé.
(3) *Enicocephalus fulvescens*, also from Gum animé.
(4) *Enicocephalus tasmanicus*, from Van Dieman's Land.

The genus, although rare, has therefore a wide geographical distribution. So far as I know, no species has been described since Westwood's characterization of the genus fifty-five years ago; indeed, the genus appears totally unknown to all our modern entomologists.

The genus was recognized in some St. Vincent material sent to Dr. C. V. Riley to be worked up for the British Museum, by the identification of *E. flavicollis*. It is also gratifying to me to

announce to-night the discovery of a new species, in this remarkable genus, in our fauna, made by one of our members, Mr. E. A. Schwarz, last spring in Utah.

The genus is evidently an ancient phylogenetic type, now nearly extinct, of the family *Reduviidæ*, remarkable for having the elytra entirely membranaceous with a distinct venation, not unlike certain saw-flies, in having greatly swollen anterior legs, the fore tarsi being 2-jointed, whilst the middle and hind tarsi are 3-jointed. It will not fit into any of the subfamilies of the *Reduviidæ*, as defined by Stal, and will form the type of a new subfamily, which may be known as the *Enicocephalinæ*.

Prof. Westwood says: "The very remarkable head, thorax, fore legs, and hemelytra distinguish these curious insects, not only from the remainder of the extensive family of the *Reduviidæ*, but also from every other Hemipterous group." In this I quite agree. It appears to me as though the affinitives of this rare genus were equally divided between the *Reduviinæ*, *Salyavatinæ*, and the *Stenopodinæ*, and I should place it between the *Reduviinæ* and the *Salyavatinæ*; the latter not represented in America. The species collected by Mr. Schwarz in Utah is exhibited to-night, and below I give a brief description, naming it *schwarzii*, in honor of its discoverer.*

Enicocephalus (*schwarzii* Ashm. MS., olim) **culicis** Uhler. ♂.—Length 2.8 mm. Rufo-piceous; anterior lobe of head blackish; rostrum and anterior legs, testaceous; tylus, middle and hind legs, and abdomen pale flavo-testaceous; elytra membranaceous, subhyaline.

The whole insect is pilose. Head as long as the pro and meso-notum united, with a strong transverse constriction behind the eyes, the posterior lobe thus formed being a little shorter than the anterior lobe, thicker and sub-globose; the ocelli large, red, placed at the anterior margin; eyes prominent, large, round, and black. Rostrum short, 3-jointed, the second joint a little more than twice the length of the first; the last joint acute, a little longer than the first. Antennæ 4-jointed, the first the shortest and stoutest, the second and last about equal, the last being fusiform, the third cylindrical, a little longer than the second. Thorax depressed, anteriorly subtrapezoidal, the collar distinct, short; mesonotum divided at its basal third by a transverse furrow into two lobes, the anterior lobe being two-thirds the length of the posterior, the lateral margins arcuate; posterior

*Since this was read a paper by Prof. Philip Uhler has appeared in a late number of Transactions of the Maryland Academy of Sciences, in which is described an Hemipteron, under the name *Hymenodectes culicis* (n. g. and n. sp.) and what is evidently the same insect. It appeared to me that the insect from Utah scarcely differed sufficiently from a typical specimen of *Enicocephalus* from St. Vincent to warrant the erection of a new genus; but in this Prof. Uhler is much more competent to decide than myself. The specific name proposed by me must fall.

angles of the hind lobe very slightly curved, the lateral margins oblique, the posterior margin a little sinuate within; scutellum large, triangular; metathorax quadrate. Elytra membranaceous, subhyaline, with a distinct venation, and a stigma not unlike a saw-fly. Front legs very much swollen; the tibiæ much dilated toward apex; the apical edge surrounded with seven short, stout teeth; tarsi very short, 2-jointed, ending in two long, black claws, the inner claw the longer; middle and hind legs slender, their tarsi 3-jointed. Abdomen sessile, depressed, oblong-oval, pilose, testaceous.

Hab.—Utah Lake, Utah.

Types in Coll. Ashmead and Heidemann.

Discovered by Mr. E. A. Schwarz.

In the discussion that followed, Mr. Schwarz said that he was quite certain that the same species of Enicocephalus occurred also near Washington, D. C., since he had found two specimens some years ago in a meadow on the Virginia side of the Potomac. In Utah it occurred at the shores of Great Salt Lake and Utah Lake, under stones, old leaves, etc. Prof. Riley asked if the species was not clearly allied to Anthocoris. Mr. Ashmead replied that the relationship was quite close, pointing out the connecting characters. Mr. Hubbard stated that he believed he had seen the same insect in the mountains of Montana and in the Yellowstone Park, which indicated that the species was a widely distributed one. Mr. Heidemann reported that he had not yet found it about Washington.

Mr. Mally then read a short note on *Micromus insipidus*. At Holly Springs, Miss., pupæ of this Hemerobiid were found, late in September and October, between the involucres and bolls of cotton. At this time some adults were issuing, and this proved to be true also of the pupæ collected, for they hatched a few days later. The pupæ could easily be observed through the rather sparse webbing of white silken threads loosely woven about them. The larvæ found upon cotton fed for the most part upon the plant-lice infesting this host-plant. Mr. Ashmead stated that he had reared what was probably the same insect from the egg in Florida. He had found it feeding on aphids on the orange, and pointed out the distinguishing characters between it and Hemerobius. Prof. Riley asked if the egg was pedicellate as in Hem-

erobius, and Mr. Ashmead replied that the egg was similar in this respect, but the pedicel was somewhat shorter.

Mr. Howard presented the following:

NOTE ON THE HIBERNATION OF CARPENTER BEES.

By L. O. Howard.

[*Author's Abstract.*]

Mr. Howard exhibited a pine branch burrowed by *Xylocopa virginica* and containing two specimens of the bee, a male and female. This burrow was brought to him in February, at which time the male was living, although the female was already dead. A number of additional living bees were in the burrow when found but were lost before they reached the speaker. He stated that he had not been able to find any published statement to the effect that the males winter over, and that he had always assumed, although without observation, that, as with the Bombi, only impregnated females hibernated. The finding of this living male in February shows that the male sex does hibernate. This particular specimen was kept alive in a "queen cage" until the end of April, when it died.

Prof. Riley said that the question of the hibernation of both sexes does not seem to have been broached, but saw no reason why both should not hibernate. Mr. Ashmead reported having taken both sexes in early spring about flowers. Mr. Hubbard stated that the Carpenter bees are extremely abundant at Crescent City, Florida, and that at that latitude no hibernation occurs, the breeding continuing almost without intermission the year round. He had observed them throughout the winter, during which season they were excessively injurious to woodwork, porches, fences, window-sashes, etc., the adults being very abundant during the months of November to January. He had found in February the eggs and the young, in various stages of development, in burrows, and in March the adult bees ready to issue from the burrows. By April most of these had escaped, and another generation developed during the summer. He described the egg of the Carpenter bee as the largest, finest, and most beautiful of any insect egg he had ever seen. He described it as a quarter of an inch in length, and perfectly transparent, revealing the embryonic larva

with great clearness. Mr. Howard stated that in the District of Columbia they begin their burrows about the middle of April, and said that in April, 1891, he had destroyed some six or seven females, all of which had come, one after another, to the same spot on the lintel of his front-door to construct their burrows. Prof. Riley said that it would be interesting to record the fact that this genus is parasitized by *Anthrax*, which is also parasitic on so many other boring bees, and other insects of like habits.

Mr. Hubbard gave some additional observations on the nature of the work of the Carpenter bees, in which he stated that on his place in Crescent City, Fla., they will construct their burrows in a kind of "hard-pan" or soft sandstone, which he used in lieu of brick in the construction of the foundations of green-houses, etc., and in one instance he had known a supporting pier to be honey-combed and undermined by these creatures. Prof. Riley said that the first specimen which he figured was obtained by Mr. Walsh, in winter, from a burrow in a brick wall.

The Corresponding Secretary presented on behalf of the author the following paper:

NO ES ON THE NEARCTIC ARADIDÆ.

BY DR. E. BERGROTH.

Since many years occupied with the study of the Aradidæ, I have also had to examine a great many North American forms of this difficult but interesting family. Having recently received fresh material from Mr. E. P. Van Duzee, of Buffalo, and Mons. A. L. Montandon, of Bucharest, I here give some additions to my notes on North American Aradidæ, published in some European journals.

1. *Aradus similis* Say.

In the *Revue d'Entomologie*, Vol. VI (1887), p. 246, I have described a new species under the name *A. centriguttatus*; this insect is only a variety of *similis*.

2. *Aradus ornatus* Say.

Recently I have seen a specimen fully agreeing with Say's description. The three glabrous polished spots at the hind part of the thorax, mentioned by Say, are very conspicuous also in my specimen, and seem to be a good character of this very distinct species, which is apparently extremely rare.

3. *Aradus Duzeei* n. sp.

Subovatus, fusco-niger, apice scutelli, limbis posticis segmentorum connexivi, dimidio interiore loborum genitalium liturisque corii basin versus flavidis, pedibus pallidis, antennis crassiusculis, margine laterali pronoti et partis basalis corii dense sed subtilissime crenulatis. Long. ♂ 6 mm., ♀ 6½ mm.

Male: hemelytra reaching the middle of the genital lobes. Genital segment very convex, its apical lobes depressed and reflexed, the posterior margin broadly rounded, the inner margins contiguous. Sixth segment of the connexivum distinctly longer than broad, the apical part considerably narrower than the basal one.

Female: hemelytra reaching the base of the genital lobes. Fifth ventral segment as long in the middle as at the sides, the posterior margin truncate in the middle, the apical angles distinctly reaching beyond the middle part of the sixth segment; sixth ventral segment in the middle subequal in length to the fifth, its apical angles are almost opposite the tip of the second genital segment; first genital segment shorter than the sixth ventral segment in the middle, twice as long as the second genital segment, the genital lobes a little reflexed, the posterior margin broadly rounded, the inner margins contiguous. Sixth segment of the connexivum scarcely longer than broad, the apical part a little narrower than the basal one.

Dark brown. Head a little longer than broad, with two longitudinal furrows; lateral spines valid, a little divergent, not reaching the apex of the first antennal joint, without any distinct tooth on the outer side; intraocular tubercle small, obtuse; rostrum scarcely reaching the anterior coxæ; antennæ rather thick, a little shorter than head and thorax taken together, fuscous, basal joint pale testaceous, second joint as long as the breadth between the eyes, very little shorter than the two last joints united, cylindrical, a little narrower at base, considerably longer than the third joint, which is also cylindrical, fourth joint much shorter than the third. Pronotum broadest a little behind the middle, the sides moderately reflexed anteriorly, sometimes with a paler spot, the lateral margins more rounded posteriorly than anteriorly, densely but finely crenulated, the base shortly and bluntly lobed above the base of the corium, the disk with four parallel ridges, the inner ridges approximate, the outer ones evanescent anteriorly; besides these ridges there is the usual abbreviated ridge at the basal angles of the pronotum. Scutellum elongate-triangular, gradually and equally tapering from the base to the tip, twice as long as broad, nearly reaching the posterior margin of the second abdominal segment, rather broadly yellow at the apex. Hemelytra dark fuscous, the transversal nervures and the somewhat dilated basal part of the corium, except the exterior margin (which is densely and very finely crenulated), are yellow. Abdomen fuscous, the posterior margins of the segments of the connexivum and the inner half of the genital lobes tawny, posterior

margin of the fifth ventral segment in the middle reddish or yellowish, the sixth ventral segment in the middle and the genital segments dark testaceous, the apical angles of the abdominal segments very little and obtusely prominent. Legs pale testaceous, the femora sometimes a little darker in the middle.

Mr. Van Duzee found several specimens of this insect at Ridgeway and Muskoka, Ontario. Mr. Montandon has two specimens from Pennsylvania.

I am surprised to find that this handsome species is yet undescribed, but I think it may stand in some American collections as *ornatus* Say. Before receiving the true species of Say, I had myself determined it as *ornatus*. Say's species is, however, easily distinguished from *Duzeei* by the following characters: the head is shorter; the second joint of the antennæ is much more incrassated towards the apex (the two last joints are wanting in my specimen); the thorax is shorter, more transverse, having the lateral margins equally rounded and the greatest breadth in the middle; the scutellum is shorter, more widened at base, with the apex entirely black; the basal part of the corium is more dilated and more strongly rounded at the lateral margin; the color of the hemelytra and abdomen is much lighter; the genital lobes are obliquely truncate or subsinuate at the posterior margin; their basal half (not the inner half as in *Duzeei*) is yellow.

A. robustus Uhl. is also similar to *ornatus*, but, apart from the very different color, is easily distinguished by having the scutellum more parallel towards the base and the ventral and genital segments quite differently shaped.

4. *Aradus abbas* Bergr.

This fine insect, described from Quebec, has been found by Mr. Van Duzee at Sudbury, Ontario, and at Colden, N. Y. It is easily distinguished from *A. lugubris* Fall. by the very long and thin antennæ, which are narrowly biannulated with white. *A. breviatus* Bergr. is a very similar species, but the genital lobes of the female are entirely different.

Being now acquainted with all the Aradidæ of boreal America, except *Ancurus simplex* Uhl. and the uncertain species of Walker, I think it useful to publish a systematic list of them with indications of their geographical distribution.

In his "check-list" Prof. Uhler has enumerated, among the Aradidæ, a *Dacerta mediospina* Sign. from the West Indies. The generic name of this insect is *Dacerla* (not Dacerta); it is not described as an Aradid, but as a Lygæid of the division *Myodochina*; it is not from the West Indies, but from California. Signoret has only described the genus (Bull. Soc. Ent. Fr. 1881,

p. clvii); the species, named *mediospinosa* (not *mediospina*), has never been described.

Gen. *Aradus* Fabr.

æqualis Say, New Hem. of N. A. 1831, p. 29; Compl. writ. I, 352.
Canada, New Jersey, Indiana, Illinois, Indian Territory, Texas.

quadrilineatus Say, Journ. Ac. Sc. Philad. IV, 326 (1825); Compl. writ. II, 249. (Syn.: robustus Prov.)
Canada, New England, New York, Pennsylvania, Maryland, North Carolina, Florida, Missouri.—Also in Panama (Uhler).

robustus Uhl., Proc. Boston Soc. Nat. Hist. 1871, p. 104, and 1878, p. 419. (Syn.: quadrilineatus Prov.)
Canada, Massachusetts, New Jersey, New York, Maryland, Illinois Wisconsin.

fuscoannulatus Stal, Freg. Eugenies resa, Hem., p. 260 (1859).
California.

Duzeei Bergr., *supra*.
Canada, Pennsylvania.

ornatus Say, New Hem. of N. A. 1831, p. 29; Compl. writ. I, 352.
Pennsylvania (Montandon's collection), Indiana.

Behrensi Bergr., Wien. ent. Zeit. V, 97 (1886).
California.

similis Say, New Hem. of N. A. 1831, p. 28; Compl. writ. I, 351. (Syn.: centriguttatus Bergr.)
British America, Sitka (Sahlberg), Maine, New York, Maryland, South Carolina, Florida, Illinois, Alabama.

debilis Uhl., Bull. U. S. Geol. Surv. II, 5, p. 322 (1876).
British Columbia (my collection), Vancouver Island.

acutus Say, New Hem. of N. A. 1831, p. 28; Compl. writ I, 351. (Syn.: americanus H. Sch.)
Canada, South Carolina, Georgia, Florida, Indiana, Alabama, Colorado, Texas, California.

inornatus Uhl., Bull. U. S. Geol. Surv. II, 5, p. 323 (1876).
Pennsylvania, Maryland, South Carolina, Georgia, Wisconsin, Illinois, Nebraska, British Columbia.

crenatus Say, New Hem. of N. A. 1831, p. 28; Compl. writ. I, 350.
Canada, Alabama.*

ampliatus Uhl., Bull. U. S. Geol. Surv. II, 5, p. 321 (1876).
California.

tuberculifer Kirby, in Richardson, Fauna bor.-amer. IV, 278, pl. VI, fig. 5 (1837).
British America, Colorado, California.

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* This species is no doubt widely distributed in the Atlantic States, but I have only examined Canadian specimens, and have only found one precise record of it in the literature.

lugubris Fall., Hem. Suec., p. 139 (1829). (Syn.: rectus Say, affinis Kirby.)
British America, New England, North Carolina, Georgia, Florida, Missouri, Colorado, New Mexico, California.—Also in Europe.

abbas Bergr., Bull. Soc. Ent. Belg. 1889, p. CLXXX.
Canada, New York.

breviatus Bergr., Rev. d'Ent. VI, 245 (1887).
Florida.

cinnamomeus Panz., Fauna Ins Germ. XX (1794).
Missouri, Texas.—Also in Europe.

niger Stal, Enum. Hem. III, 137 (1873).
South Carolina.

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proboscideus Walk., Cat. Hem. Het. Brit. Mus. VII, 35 (1873).
British America.

caliginosus Walk., l. c., p. 36.
British America.

fasciicornis Walk., l. c., p. 36.
Nova Scotia.

fenestratus Walk., l. c., p. 36.
British America, Rocky Mountains.

Gen. *Brachyrrhynchus* Lap.

lobatus Say, New Hem. of N. A. 1831, p. 30; Compl. writ. I, 354.
Canada, Pennsylvania, Maryland, Michigan, Indiana, Illinois, Missouri, Texas, California.

granulatus Say, New Hem of N. A. 1831, p. 30; Compl. writ. I, 353 (Syn.: parvulus H. Sch.)
Canada, Maryland, North and South Carolina, Florida, Indiana, Alabama, Missouri, Texas.—Also in Cuba and Mexico (Berlin Museum).

mœstus Stal, Stett. ent. Zeit. XXIII, 438 (1862).
Arizona, California.—Also in Mexico.

Gen. *Pictinus* Stal.

Aurivillii Bergr., Rev. d'Ent. VI, 247 (1887).
Georgia.

Gen. *Neuroctenus* Fieb.*

simplex Uhl., Bull. U. S. Geol. Surv. II, 5, p. 323 (1876).
New England, Pennsylvania, Maryland, Carolina, Georgia, Florida, Illinois, Missouri, Indian Territory, Texas.—Also in Cuba.

ovatus Stal, Stett. ent. Zeit. XXIII, 439 (1862).
North Carolina (Morrison, Stockholm Museum).—Also in Mexico.

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* I have monographed this genus in *Ofversight of Finska Vetenskaps-Societetens förhandlingar* XXIX (1887), 173–189.

Gen. *Aneurus* Curt.

politus Say, New Hem. of N. A. 1831; Compl. writ. I, 354.
Florida.—Also in Cuba.

septentrionalis Walk., Cat. Hem. Het. Brit. Mus. VII, 30 (1873).
(Syn.: politus Prov.)
British America.

inconstans Uhl., Proc. Boston Soc. Nat. Hist. 1871, p. 105 and 1878, p. 420.
Canada, Massachusetts.

simplex Uhl., Proc. Boston Soc. Nat. Hist. 1871, and 1878, p. 421.
New England.

sinuatus Bergr., Verh. zoöl.-bot. Ges. Wien XXXVI, 58 (1886).
Texas.

TAMMERFORS, FINLAND, *March 29, 1892.*

ADDITIONAL NOTE ON NEARCTIC ARADIDÆ.

By Dr. E. Bergroth.

Having received further materials of North American Aradidæ, I find it necessary to add the following to my paper:

1. *Aradus concinnus* n. sp.

Subovatus, fusco albido et ferrugineo varius, pronoto lateribus denticulato, scutello basin versus subparallelo. Long. ♂ 4.8 mm.

Head dark, fuscous, a little longer than broad. Antenniferous spines armed with a distinct tooth on their outer side. The tubercle near the eyes very distinct. Antennæ rather short and stout, dark fuscous; the first and third joints, except the inmost base of the latter, are sordid yellowish, the second joint annulated with the same color immediately before the middle; the third and fourth joints are subequal in length, each almost half as long as the second, which is gradually incrassated towards the tip. Rostrum reaching the middle of the mesosternum. Thorax not quite thrice as broad as long, narrower than the hemelytra at their dilated part, light fuscous with a whitish patch at the antero-lateral margins, the sides denticulated and obtusely angulated, the greatest width is in or immediately before the middle and from this point the sides are much less converging towards the base than towards the apex, the antero-lateral margins very slightly rounded, the postero-lateral margins straight; the disk bears six parallel fuscous keels, of which the outermost is abbreviated in the usual way. Scutellum with the sides nearly parallel from the base to the middle, then converging towards the apex, the disk yellowish with the basal part to near the middle fuscous, the sides from a little behind the middle to the tip margined with black. Breast ferruginous in the middle, acetabula whitish. Hemelytra in the male almost reaching the apex of the abdomen, widened, rounded, and somewhat

reflexed at the basal part, the outer margin of the dilated part denticulated, corium nearly reaching the apical angle of the fourth segment of the connexivum, whitish, the narrow interstices between the transverse veins, the two longitudinal ridges, a transverse ridge behind the middle of the mesocorium, and the apical margin between the ends of the longitudinal ridges fuscous, membrane fuscous with the veins broadly whitish. Abdomen ferruginous, a small round spot at the inner basal angle of the segments of the connexivum and the outer margin of these segments dark fuscous, this dark border narrowly interrupted at the angles. The shortly explanated apical lobes of the genital segment in the male rounded, meeting interiorly in an angular incision. Legs dark luteous, femora biannulated with brown, tibiæ annulated with brown before the apex.

South California (Morrison).—Stockholm Museum.

Somewhat allied to *A. fuscoannulatus* Stal, but, apart from the very different color-markings, easily distinguished by the shape of the scutellum.

2. *Aradus similis* Say.

Texas is to be added as the southmost locality of this species.

3. *Aradus Falleni* Stal.

Vet. Ak. Handl. II, 7, 1860, p. 68. (Syn.: pallidicornis Stal, Enum. Hem. III, 1873, p. 136.)

This species is to be added to the North American fauna.

There is a specimen from Texas, taken by Belfrage, in the Stockholm Museum. It is previously known from the West Indies and Brazil.

4. *Aneurus minutus* Bergr.

In this species the hemelytra are sometimes milky white with with the base of the corium narrowly brown.

A comparison with the palæarctic Aradidæ shows the following number of species for the two regions:

	Nearctic region.	*Palæarctic region.*
Aradus Fabr.	25	55
Aradosyrtis Costa	0	1
Brachyrrhynchus Lap.	3	8
Pictinus Stal	1	0
Neuroctenus Fieb.	2	0
Aneurus Curt.	5	2
Joppeicus Put.	0	1
	36	67

Mr. Doran then read a paper by Mr. F. M. Webster on—

FOOD-PLANTS OF THE LIXI.

By F. M. Webster,
Columbus, Ohio.

So far as our knowledge of the habits and development of the species of Lixus goes, they seem to be confined in their selection of food to annual plants, several of which, as the bean, beet, cabbage, rhubarb, etc., are cultivated. With regard to European species, we find in P. Bargagli's useful work on the Biology of the European Rhynchophora* a compendium of the food habits of the imagos and the breeding habits of the larvæ.

Mr. Townend Glover (Rep. Comm. Agric., 1865, p. 90) gives us our first knowledge of the food-habits of our own species, recording the fact of *L. concavus* ovipositing in the leaf stalks of Rhubarb, *Rheum rhaponticum* L., at Washington, D. C., although some years ago, in Illinois, I reared this species from wild sunflower, *Helianthus grosse-serratus* (*Entomol. Amer.*, vol. 5, p. 11). Prof. C. M. Weed claims to have reared it also from dock, *Rumex*, here in Ohio, but the species bred by him is *L. mucidus*, as determined by Dr. Horn, and it does not appear that the former has reared *concavus*. *L. macer* has been reared from *Helianthus grosse-serratus* in Illinois by myself, it having previously been observed in the same State ovipositing in this plant by Mr. Coquillett (*Entom. Amer.*, vol. 5, p. 11). Dr. C. V. Riley has reared this species from *Chenopodium hybridum* in Missouri (*Proc. Ent. Soc. Washington*, vol. 1, p. 33), and he also states that *L. parcus* forms galls on the stems of *Amelanchier* in California.

According to Dr. J. A. Lintner, *L. rubellus* was observed on two occasions in large numbers clinging to the flowers of *Polygonum amphibium* in a pond in Massachusetts, rendering it probable that this is the food-plant of the imago and larva. This theory is considerably strengthened by the rearing *L. musculus* from this plant, in southern Michigan, by Dr. D. S. Kellicott, and *L. terminalis* from stems of *Polygonum pennsylvanicum* by Prof. Forbes in Illinois (16th Rep. State Ent. Ill., p. 76), although the fact is clearly shown that the same species may feed on plants of widely different character, or two different species may breed in the same plant. Quite recently, Mr. D. A. Hopkins, of West Virginia, has reared *L. scrobicollis* from *Ambrosia artemisiæfolia* and *A. trifida* (*Insect Life*, vol. 4, p. 256).

Tabulating our information on the breeding habits of Lixus, we have the following:

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*Rassegna biologica di Rincofori Europei. Published in Bullet. Soc. Ent. Ital., 1883-1887.

European Species.

Species.	*Food-Plant.*	*Authority.*
L. paraplecticus L	Anthriscus ceræfolium	Zetterstedt.
	Phellandrium aquaticum	Kaltenbach.
L. iridis Oliv	Cicuta virosa	Bargagli.
	Pastinacea sativa	Bargagli.
L. anguinus L	Brassica oleracea	Bargagli.
L. mucronatus Oliv	Sium latifolium	Dufour.
L. cylindrus F	Artemisia campestris	Ghiliani.
L. ascanii L	Beta vulgaris	Bargagli.
	Sisymbrium sophia	Bargagli.
L. myagri Oliv.	Sisymbrium aquaticum	Letzner.
L. algirus	Malva silvestris and other Malvaceæ	Perris.
L. cylindricus Hbst	Rumex hydrolaphatum	Dieckhoff.
	Rumex acetosa	Bargagli.
	Cicuta virosa	Marseul.
L. bicolor Oliv	Senecio aquaticus	Goureau.
	Geraniaceous plant	Grenier.
L. elongatus Germ	Senecio jacobæa.	Bargagli.
L. junci Boh	Beta cicla	Rosenhauer.
L. pollinosus Germ	Onopordon acanthium	Bargagli.
L. filiformis F	Cynara ferox	Bargagli.
	Cynara eryophorus	Bargagli.
L. cribricollis Boh	Rumex acetosa	Bellevoye.
	Vicia faba	Bargagli.

American Species.

L. rubellus Rand	Polygonum amphibium (?)	Lintner.
L. parcus Lec	Amelanchier	Riley.
L. terminalis Lec	Polygonum pennsylvanicum	Forbes.
L. mucidus Lec	Rumex crispus	Weed.
L. scrobicollis Boh	Ambrosia artemisiæfolia	Hopkins.
	Ambrosia trifida	Hopkins.
L. concavus Say	Rheum rhaponticum	Glover.
	Helianthus grosse-serratus	Webster.
L. musculus Say	Polygonum amphibium	Kellicott.
L. macer Lec	Helianthus grosse-serratus	Coquillett. Webster.
	Chenopodium hybridum	Riley.

From the records it appears that some of the species are semi-aquatic, viz., *L. rubellus* in our fauna and several European species; the larvæ of most species are boring in the stems of

plants above the surface of the ground; the larvæ of a few species (*bicolor*, *elongatus*, *myagri*, and *mutidus*) are crown-borers or even bore in the roots of plants; two of our species, *concavus* and *macer*, girdle the stems from within, while *musculus* and *parcus* form galls or swellings on the stems which they inhabit.

The more strongly developed anterior femora in *macer* appear not to have been generally observed, and would lead us to look for some habit of this species differing from those of its congeners, and calling for superior muscular powers and greater length of these parts.

Mr. Schwarz remarked that the discovery of the food habits of *Lixus rubellus* should not be credited to Dr. Lintner, but to Mr. Fred. Blanchard, who published a note on the subject in the first volume of *Psyche*.

Mr. Hubbard then read the following:

DESCRIPTION OF THE LARVA OF AMPHIZOA LECONTEI.

BY HENRY G. HUBBARD.

Body elongate, fusiform, widest in the middle, regularly arcuate on the sides, tapering gradually to a conical tip, strongly convex above; the dorsal shields chitinous, entirely covering the segments, and with broadly explanate margins; beneath moderately convex, not chitinous. Color above varying with the moults from testaceous to piceous; the head darker; beneath yellowish white; head, legs, and tip of body testaceous. The upper surface with fuscous markings obliquely crossing each segment, commencing with the mesothorax, and forming, when the body is contracted, two dorsal and two submarginal bands, the former more sharply defined than the latter. The prothorax shows on either side of the dorsal face a cluster of translucent spots, like dots and dashes of the Morse alphabet, produced by indentations reducing the thickness of the chitine; each of the following segments with a smaller cluster of similar spots. Chitinized portions of the body strongly punctured, in some places transversely rugose, sparsely covered with procumbent bristles curved at the ends. A deeply incised median furrow from the head to the apex of the body. Length, 12-13.6 mm.; width, 4.1 mm.

Head rather large, hexagonal, more convex below, widest behind the middle, angularly narrowed behind, minutely narrowed anteriorly; genæ forming a ridge, curving upwards, not reaching the posterior margin; front margin above and below nearly straight; hind margin above straight, below sinuous; upper surface with shallow foveæ on the vertex, each branch of the Y-suture ending in a deep sinus at the base of the mandible; underside with anterior border rising abruptly from a broadly arcuate

depression extending entirely across the head; two deeply impressed foveæ or pores near the middle of the head. • Clypeus prominent, arcuate, with a tubercular prominence on either side, the thickened margin fringed below with spinulous hairs; deep emarginations of the frontal margin separate these prominences from the elevated anterior angles of the head.

Ocelli six, placed immediately behind the antennæ, four on the upper surface and two on the lower surface of the head, the middle pair on the verge of the marginal ridge.

Antennæ supported on elevations of the anterior angles of the head, shorter than the mandibles, consisting of a thickened fleshy base and three cylindrical joints; the first joint stout, transverse; the second more slender, elongate; the last joint shorter than the preceding, tapering, rounded at the tip, with a terminal pore.

Labrum a trapezoidal glabrous plate completely enclosed within the buccal cavity, of which it forms the roof; a fringe of hairs on the posterior border closes the opening of the œsophagus.

Mandibles about one-third as long as the head, stout, falciform, basal half thickened, distal portion more strongly curved from a sinus near the middle, deeply channelled inside, forming sharp cutting edges, the inferior edge with a single sharp denticle and several very minute serrations near the middle.

Maxillæ longer than the mandibles, the base thickened, elongate, cylindrical, obliquely truncate at tip, bearing a four-jointed palpus and a two-jointed inner lobe; the first two joints of palpus subequal, as wide as long; the third joint equal to the two basal joints in length, enlarged at tip; terminal joint longer than the preceding, more slender, truncate at tip; the joints of the inner lobe subequal in length, the first thickened anteriorly, the terminal joint acuminate.

Labium consisting of a broadly transverse, three-lobed mentum with straight borders, surmounted by a transverse, trapezoidal ligula, widening anteriorly, with a row of short bristles beneath near the anterior border, and bearing short, two-jointed palpi, the basal joint as wide as long, the terminal joint three times as long as the preceding, tapering to a blunt point.

Prothorax more than twice as wide as long, narrowed anteriorly, sides moderately arcuate, anterior angles produced rectangular, hind angles rounded; the two following segments subequal, together slightly exceeding the prothorax in length, sides arcuate and angles rounded.

Legs moderately long, subequal and similar, of five cylindrical joints and two claws; coxa stout, elongate; trochanter rather slender, curved, pointed at both ends; femur nearly as long as the coxa; tibia shorter, twice as long as wide; tarsal joint longer, more slender, ending in two short, simple claws, slightly curved, thickened at base and divergent at the tips; all the joints sparsely covered with minute spines, longer and more numerous on the inner edge.

Abdomen of eight segments, and a pair of anal stylets (9th segment ?)

entering the last segment from below; first segment slightly wider than the metathorax, shorter than the following segments, anterior and posterior angles equally rounded; segments two to seven subequal in length, diminishing in width, sides successively more arcuate, with hind angles gradually more produced, becoming on the seventh segment reflexed acuminate points; eighth segment longer than the preceding, with marginal explanations reduced to carinæ, produced above in an obtusely rounded convex tip, and terminating in a pair of large valvular spiracles which resemble the nostrils of a seal; beneath, a transverse, trapezoidal, slightly convex plate narrowed posteriorly; anal stylets as long as the eighth segment measured dorsally, stout, tapering to a blunt point, deflexed, inserted beneath the dorsal prolongation of the last segment, base deeply cleft, enclosing the anal opening.

Stigmata obsolete, represented by small chitinous buttons placed close to the anterior angles on the side margins of each ventral segment, beginning with the mesothorax and ending with the seventh abdominal segment; two active spiracles on the eighth segment are terminal and placed close together.

The body is very strongly chitinized above, with deep sutures on the dorsum, into which the anterior edges of the segments are deflected from a sharply defined submarginal line. This line marks the limit to which the dorsal plates can overlap when the body is contracted; in this position the head and tail are in the same straight line, the explanate lobes on the sides overlap broadly, the body is regularly fusiform, tapering rapidly behind, and the form resembles a silphid of the first group (Silpha, Necrophorus, etc.) When distended, however, the side lobes become widely separated, the form elongates greatly, and the appearance of the larva becomes caraboid. The simple ventral folds are not capable of distending as much as the dorsal sutures; the body, therefore, tends to arch downwards at the extremities; thus full-fed or distended larvæ are strongly curved.

The color varies in different specimens from piceous to testaceous; when darkly chitinized the dusky mottlings or bands are more or less obscured. In dark specimens also smoky patches appear on the face of the ventral segments. The ventral surface is entirely glabrous, but the convex upper surface shows, under a lens, a sparse pubescence consisting of hooked bristles which retain particles of dirt and lime precipitated from the water, although this was not observed to form a solid coating as it does upon many of the adult beetles.

The larva lives, with the imago, along the sides of rapid mountain streams, and, although submerged, evidently does not wander far beneath the surface. It was especially abundant in the eddies, in dark places, where it clung to floating sticks and willow catkins, or crawled slowly among small stones at the water's

edge. Like the imago, it does not swim, and when detached from the débris to which it clings sinks helplessly to the bottom or is swept away by the current.

The nature of its food was not discovered, but the large size and form of the buccal cavity shows that it masticates its food and, if carnivorous, is not rapacious.

Described from seventeen alcoholic specimens collected in City Cañon, Utah, June 26, 1891, and one specimen from American Fork Cañon, Utah; the last is a dark, strongly chitinized specimen, and has turgid elevations, above and below, on the explanate margins of all the segments.

The larva of Amphizoa presents a structure severely simple, yet well differentiated in all its parts, and, like the imago, gives the impression of a terrestrial beetle with amphibious or semiaquatic habits. In general appearance it recalls the larva of Cychrus. The solid, non-suctorial jaws, lobed maxillæ, and ambulatory legs show close alliance with the caraboid type, and effectively separate it from the Dytiscidæ. An approach to the latter family is made in the concealed ninth joint of the abdomen and the terminal spiracles of the eighth abdominal segment, structures adapted to an aquatic life. With the Old World genus Pelobius the larva of Amphizoa is strikingly allied in many structural details. The suctorial jaws of the Dytiscidæ are wanting in both genera. The larva of Pelobius, being wholly aquatic, breathes by means of fasciculate branchiæ, and the obsolete spiracles are represented by buttons. In Amphizoa there are no branchiæ in the adult larva, and the animal breathes by means of a pair of spiracles at the end of the body. But the structure of the abdomen is essentially the same, the eighth segment being terminal in both genera. This segment in Amphizoa bears air-breathing spiracles, is slightly prolonged and capable of being protruded into the atmosphere from shallow water, but in Pelobius it is greatly prolonged into a natatory stylus. The cerci in the two genera arise in a precisely similar manner from the rudimentary ninth segment, and conform to the differences in their habits of life, being short spiny processes, assisting in progression in Amphizoa, but in Pelobius developed into long ciliated natatory organs.

The larval characters in Amphizoa indicate an ancient synthetic type, having alliances with several existing families of coleoptera, but sufficiently isolated to forbid its entrance into any one of them.

Schiödte in his classification of coleopterous larvæ* has clearly pointed out the fundamental differences which separate the

*De Met. Eleuth. Observ. No. 6 (Kröyer Naturh. Tidsskrift, Vol. VIII. 1872, pp. 174-178.

families of adephagous coleoptera. The introduction of the Amphizoidæ between the Carabidæ and the Pelobiidæ requires but slight alterations in the scheme proposed by him.

Thus extended Schiödte's table may be given briefly as follows:

Principal Types of Larvæ with Exserted, Mobile Tarsi, Bearing Claws, etc.

I. Mandibles closed (non-suctorial).

a. Mandibles with a retinaculum (strongly toothed).
Spiracles open; eight pairs on the abdomen.
Branchiæ none.
Ninth abdominal segment exserted; anal segment exserted, motatory.
Abdomen ambulatory. Legs ambulatory.

1. *Cicindelidæ.*

External maxillary lobe arising from the palpigerous piece of the stipes, immovable. Maxillary stipes oblique. Maxillary grooves impressed upon the genæ. No cerci. Ocelli in fours.

2. *Carabidæ.*

External maxillary lobe arising from the stipes, mobile. Maxillary stipes porrect. Maxillary grooves none. Cerci present. Ocelli in sixes.

b. Mandibles with rudimentary retinaculum (denticulate).
Spiracles in part closed; eight pairs on the abdomen, the terminal pair alone open.
Branchiæ none.
Ninth abdominal segment concealed. Anal segment concealed.
Abdomen ambulatory. Legs ambulatory.

3. *Amphizoidæ.*

Eighth abdominal segment terminal, hardly prolonged, ending in stigmata. Cerci short, spine-like, assisting in progression. Maxillæ lobed.

c. Mandibles without retinaculum.
Spiracles minute, seven pairs on the abdomen.
Fasciculate, sanguiferous branchiæ pendant from the thoracic segments and the first three abdominal segments.
Ninth abdominal segment concealed. Anal segment concealed.
Abdomen natatory. Legs natatory.

4. *Pelobiidæ.*

Eighth abdominal segment terminal, prolonged in a motatory style. Cerci very long, natatory. Maxillæ without lobes.

II. MANDIBLES SUCTORIAL.

Ocelli in sixes.

5. *Haliplidæ.*

Ninth abdominal segment exserted. Abdomen reptorial. Antennæ frontal. Mandibles explanate. Coxæ approximate. Legs with a single claw. Front legs prehensile; middle and hind legs ambulatory. Head inclined, front greatly elevated at middle; no neck.

6. *Dytiscidæ.*

Ninth abdominal segment concealed. Abdomen natatory. Antennæ lateral. Mandibles falcate. Coxæ distant. Legs cursorial, most frequently natatorial, claws double. Head porrect. Anal segment concealed. Eight pairs of spiracles on the abdomen. Branchiæ none.

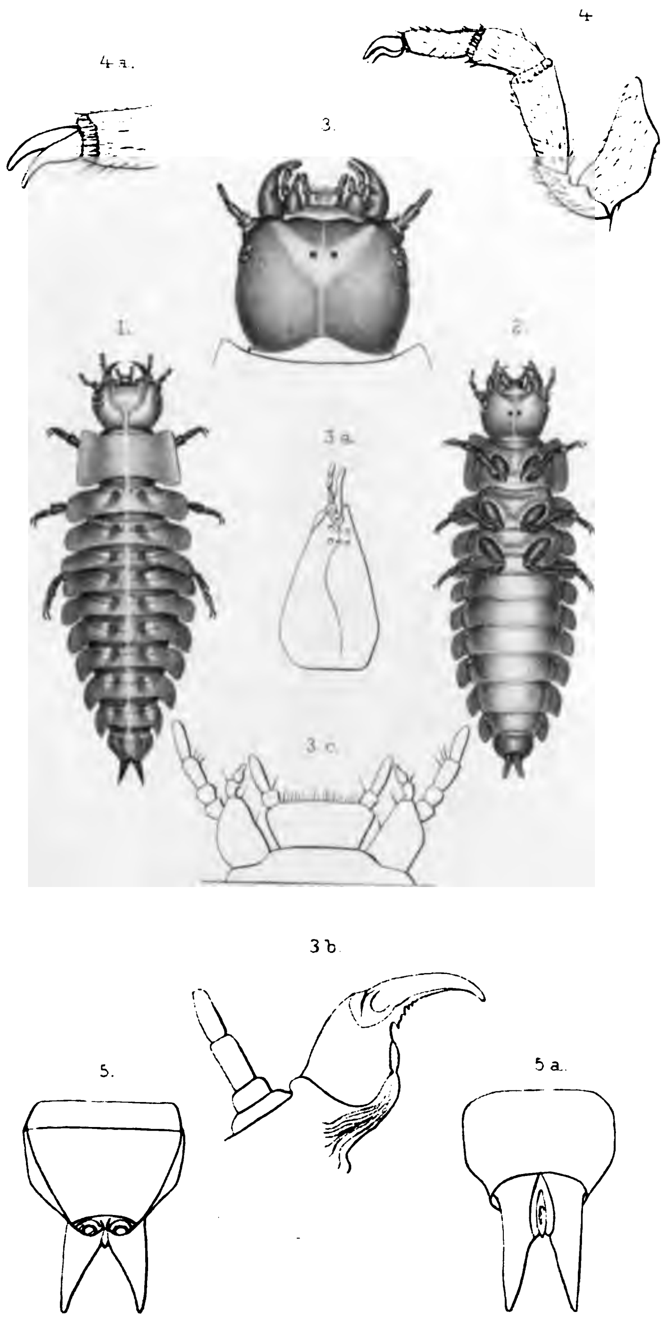
7. *Gyrinidæ.*

Ninth abdominal segment exserted. Abdomen natatorial. Antennæ lateral. Mandibles falcate. Coxæ distant. Legs ambulatory, claws double. Head porrect. Anal joint exserted, scansatorial. Spiracles none. Tracheal branchiæ issuing from the sides of the abdomen.

EXPLANATION OF PLATE III.

1. Larva of Amphizoa Lecontei from above, enlarged four times.
2. Same, from below.
3. Head of larva from below, enlarged ten times.
3a. Head, lateral view.
3b. Left mandible and antenna, from above.
3c. Maxillæ and labium, from below.
4. Leg.
4a. Claws, greatly enlarged.
5. Terminal segment, from above.
5a. Same, from below.

Mr. Schwarz remarked that while *Amphizoa lecontei* had not been bred, there could not be the slightest doubt that the larva described by Mr. Hubbard belonged to Amphizoa. The numerous imagos found in City canyon were all, more or less, thickly coated with a layer of mud, thus indicating that the pupa stage was passed in very moist soil; but the efforts made to dig for the pupa and adhering larval skin remained unsuccessful, owing to the rocky nature of the ground. The general resemblance of the Amphizoa larva to that of a Silphid was unmistakable, so that the first larva seen was taken for that of *Pteroloma tenuicornis.* This resemblance was still increased from the habit of the larva of



LARVA 'TEI Matth.

doubling upon itself when disturbed in the water, a peculiarity not possessed by Dytiscidæ or Carabidæ, even not by the silphiform larva of Cychrus. Mr. Schwarz also alluded to the peculiar odor of the imago Amphizoa, which reminded him somewhat of that emitted by Chlænius.

Mr. Masius was called upon to give his recent experience with the "bite" of *Benacus griseus*. In handling a specimen collected at the electric light he received a severe sting on the hand. The sting or puncture of this insect proved to be very painful, and his hand showed inflammation the next morning. The pain and swelling increased for two or three days, and became so troublesome that a physician was consulted, without, however, any benefit or relief. The swelling, however, gradually subsided, and in a day or two more the trouble disappeared, although at the time of the meeting the injured part was still sore. Mr. Howard called attention to the record by Mr. Glover of the latter's being bitten by a *Prionidus*, with poisonous consequences. Mr. Ashmead said that he had also been bitten by *Prionidus*, but had frequently handled *Benacus* without being bitten. He also alluded to the fact that some species of Ichneumons which are not generally considered to be capable of inflicting a sting can sting with almost as painful results as a wasp. Prof. Riley said that the experience with *Benacus* confirms the belief he has always held, that all rapacious Heteroptera sting or pierce whenever they get a position or hold giving them a purchase. He also commented on the peculiarities of individuals, which cause some of them to suffer severely from the sting or bite of an insect, while others show no effect whatever from such injury. Mr. Masius added that his previous experience with insects, such as bees and mosquitoes, and with poisonous plants, such as Rhus, had convinced him that he was peculiarly non-susceptible to the action of such poisons.

JUNE 2, 1892.

President C. V. Riley in the chair, and twelve members present.

The following were elected corresponding members:

Prof. G. F. Atkinson, Auburn, Ala.; Mr. C. F. Baker, Fort

Collins, Col.; Prof. J. H. Comstock, Ithaca, N. Y.; Prof. A. J. Cook, Lansing, Mich.; Mr. G. C. Davis, Lansing, Mich.; Mr. Ottomar Dietz, New York, N. Y.; Prof. C. H. Fernald, Amherst, Mass.; Mr. W. J. Fox, Philadelphia, Pa.; Prof. C. P. Gillette, Fort Collins, Col.; Mr. H. A. Gossard, Ames, Iowa; Mr. Ed. L. Graef, Brooklyn, N. Y.; Prof. F. L. Harvey, Orono, Maine; Mr. Samuel Henshaw, Cambridge, Mass.; Rev. W. J. Holland, Pittsburgh, Pa.; Mr. V. L. Kellogg, Lawrence, Kans.; Mr. Warren Knaus, McPherson, Kans.; Dr. J. A. Lintner, Albany, N. Y.; Mr. F. A. Marlatt, Manhattan, Kans.; Miss Mary E. Murtfeldt, Kirkwood, Mo.; Mr. B. Neumoegen, New York, N. Y.; Prof. P. H. Rolfs, Lake City, Fla.; Mr. S. H. Scudder, Cambridge, Mass.; Dr. Henry Skinner, Philadelphia, Pa.; Mr. M. V. Slingerland, Ithaca, N. Y.; Prof. F. H. Snow, Lawrence, Kans.; Mr. T. Wayland Vaughan, Mount Lebanon, La.; Prof. F. L. Washburn, Corvallis, Ore.; Dr. C. M. Weed, Hanover, N. H.; Dr. Wm. M. Wheeler, Worcester, Mass.; and Dr. S. W. Williston, Lawrence, Kans.

Dr. Geo. Marx presented the first paper of the evening, entitled "Remarks on two new publications* on the Territelariæ of the United States, by N. Banks and Eug. Simon." He first drew attention to a matter which he had emphasized in his last presidential address, *i. e.*, that one of the great obstacles to the progress of Arachnology was the absence of a well-determined collection, where the types of all American species would be accessible to the student. The unfortunate results of the absence of such a collection were illustrated in the case of the two publications named, both of which covered practically the same ground. He contrasted the two papers, one of which—that of Mr. Banks—was based on literature now out of date and was written without the aid of type specimens; while the other was based on fuller knowledge, better command of the literature, and an acquaintance with the types. He gave an account of the writings on this group of Arachnids, and deplored the conditions which led to the publication of necessarily incomplete and inac-

* Our Atypidæ and Theraphosidæ. By Nathan Banks.—Entomological News, 1892, p. 147.

Liste des espèces de la famille des Avicularidæ qui habitent l'Amérique du Nord. Par E. Simon.—Act. Soc. Linn. Bordeaux, 1891.

curate work. He took up the older classification of this group and showed how it had undergone changes, giving the present disposition of it by Simon and the reasons for his classification, concluding with a general description of the distribution and habits of these spiders.

Dr. Gill asked if Simon had introduced more satisfactory characters for the separation of the families than the relative ones formerly used, enumerating a number of characters hitherto commonly employed by arachnologists and commenting on their slight value *per se*.

Dr. Marx replied that we are very fortunate to find anything at all to distinguish families in the Arachnida and allied groups, illustrating the difficulties experienced by a reference to the classification of scorpions. He pointed out the distinguishing characters in the Territelariæ, and stated that Mr. Simon is known to be an acute and very close observer and that he has made use, in his classification, of very many and often apparently irrelevant characters, on which he has however built a most elaborate system.

Dr. Gill argued that it is a hindrance to the advance of science to erect families in any case where it is so difficult to get good, sufficient, and at the same time easily recognizable characters to separate them.

Dr. Marx wished to know where the distinction must be drawn between sufficient and insufficient differences in the separation of families, and illustrated the great difficulties met at this point by reference to various representative species of different families of Arachnids.

Dr. Riley thoroughly agreed with Dr. Gill, in thinking that families should not be erected unless suitable and important characters separating them can be pointed out, and while he was willing to have the minutest, as well as relative characters used, *if* need be, in the separation of species or even of genera, he was convinced of the necessity of having substantial differences present in the separation of larger groups.

Professor Riley also referred to the opening statement in Dr. Marx's paper and said that he had long felt the need of just such a complete typical collection as Dr. Marx referred to, and that he had long been endeavoring to secure a collection of that char-

acter for the National Museum. The danger of attempting general revisions and monographic work with insufficient material and literature, and the liability of such work to conflict with contemporary work of others better prepared with material and literature could be illustrated by several recent instances. The result has always been a large increase in the number of synonyms and duplication of species. In the same connection mention was made of other instances of work in practically the same field being carried on by widely separated individuals, one or both laboring under the same difficulties of insufficient materials and facilities for good work.

Mr. Otto Heidemann presented a note entitled "Exhibition of Drawings of certain rare Capsids," in which he pointed out some of the characters used by European authors to distinguish the species and genera in Capsidæ, and showed their applicability to American species, illustrating his remarks with some very careful and artistic drawings of rare Capsidæ. He described, also, his method of making these drawings. He said that at first he had attempted to make drawings by the use of the *camera lucida*, but was dissatisfied with the results, and now thoroughly studied the specimen with the aid of a hand lens until he was able to make a drawing of it from memory. This was first done greatly enlarged and afterwards reduced to the size desired. Professor Riley endorsed Mr. Heidemann's method, and said he believed that the true method of drawing, for natural history purposes, was first to so thoroughly study the specimen that it could be accurately drawn from memory in detail. He said also that he believed the drawings should represent the individual specimen rather than be a composite representing variations which occur in the species. The differences in various individuals, he thought, should be either pointed out in the descriptive matter or in additional side figures. Dr. Gill also urged that illustrations should represent individual specimens, except where the specimen which was best suited for illustration happened to be, for any reason, mutilated. The mutilated portion could be restored from some other specimen, but the restored part should be pointed out in the descriptive matter accompanying the illustration.

Mr. Howard presented the following:

A NOTE ON THE PARASITES OF THE COCCIDÆ.

By L. O. Howard.

Dr. Bergroth in a recent letter has called my attention to certain statements made by C. Aurivillius in a paper entitled "Arrhenophagus, ett nytt slagte bland Encyrtiderna," published in *Entomologisk Tidskrift*, Volume IX, Nos. 3-4, 1888, concerning the economy of some parasites of bark lice. Owing to my unfamiliarity with the Swedish language, I was acquainted only with the Latin descriptive portion of this paper up to the time of receiving Dr. Bergroth's letter. Mr. Linell has since done me the favor to translate Aurivillius' general remarks, from which I may quote as follows:

Since a few years occupied with the study of our Coccids, I have also paid attention to the peculiar forms of the family Pteromalidæ that are parasites of the Coccids. These parasites, that belong to the groups Encyrtinæ and Aphelininæ, are generally obtained out of the Coccus female, at the same time or somewhat before the eggs beneath them are hatched, and they appear not in any way to check the development of the Coccus female or diminish the number of the eggs laid by her. These parasites do not, therefore, ruin for themselves their food supply through killing and exterminating their hostesses and their progeny, like most other parasites do, but are satisfied with the excess of food that is on hand. Different is the case with the species that parasitize in the male larva of the Coccids. These destroy entirely the male larvæ. That this is the truth is most easily proven with those species whose male larvæ almost from the very start are different from the female larvæ. This is the case especially in the species of the genus Chionaspis, whose male larvæ are covered with a narrow shield with parallel sides, while the shield of the female larvæ is broader. In regard to other genera, for instance in the family Lecaniidæ, that have in the first stage similar larvæ (in both sexes), it could be advocated that the larvæ attacked and killed by the parasites even might be female larvæ, although checked by the parasites in their development, so that they never had a chance to become larger than the male larvæ. A case that might be thus interpreted I have observed in ***Physokermes hemicryphus*** Dalm. On a small low spruce shrub I discovered (in Roslagen) last summer females of this species in great numbers attached in the usual way in the lower leaf angles of the second-year shoots. But on the leaves of the same shoots were found here and there some quite small parallel-sided coccids which I considered male larvæ and carefully preserved in the hope of obtaining out of them the hitherto unknown male. I was disappointed in this, and got from nearly one hundred small coccids that I collected from the leaves only a small parasitic Hymenopter (Aphycus sp.), one out of each. In this case either every one of the collected male larvæ has been attacked by a parasite or we must

suppose that those Physokermes larvæ, which already when quite young felt themselves attacked by the parasite, did not seek the usual place in the axils of the lower leaves but attached themselves on the leaves. It is worth mentioning that I never obtained the above-mentioned Aphycus species from the developed females of Physokermes.

My own experience with the Encyrtinæ and Aphelininæ infesting Coccidæ has been rather extensive, and I have taken an especial interest in these insects since the publication of my paper in 1880 on the parasites of the Coccidæ. This experience leads me to believe that Aurivillius' generalization will not hold. In certain cases, such as those which he specially mentions, the males may be exclusively attacked and in others the majority of the eggs may be laid upon the female sufficiently late to enable her to oviposit as freely as if she had not been attacked. In many other cases, however, and these form the majority in my experience, the females are pierced by their parasites at all stages of growth, and when thus pierced growth is arrested. For example, in the case of the common cosmopolitan *Lecanium hesperidum*, which here at Washington is extensively infested by *Coccophagus lecanii*, the female Coccid blackened by the contained parasite may be found at almost all stages of growth, at the proper season of the year, upon almost any ivy leaf which one may examine. From the smallest of these infested individuals but a single specimen of the Coccophagus will be reared, while from the largest as many as six parasites may issue. Again, the very common *Aphelinus mytilaspidis* issues frequently from the females of *Mytilaspis pomorum* before they have passed the last moult; an undescribed species of Aphycus has been reared from females of *Chionaspis euonymi* before these have reached maturity, and it is a common thing to rear small specimens of *Comys fusca* from immature specimens of several species of the hemispherical group of the genus Lecanium. In fact, a glance through the collection of Coccidæ in the National Museum reveals so many instances of this kind that it would be wearisome to note half of them. I am convinced, therefore, that as a generalization Professor Aurivillius' statement is not warranted, however true it may be of the Aphycus which he has reared from *Physokermes* or of his most peculiar and interesting genus *Arrhenophagus* infesting *Chionaspis salicis*.

Prof. Riley said he could confirm all Mr. Howard's remarks from his own experience, and that there could be no question but that Aurivillius had made but fragmentary observations and generalized from them. Mr. Ashmead agreed with the previous speakers and described a peculiarity in the male of *Physokermes* which would make this sex much more liable to parasitism than

the female. Prof. Riley said that in the majority of Coccids, on the contrary, the reverse is true, and that the females are more suited to parasitism than the males, consequently parasitism of the females is much more common.

OCTOBER 6, 1892.

President Riley in the chair. Seventeen members and one visitor present. Mr. Theodore Holm, of the Department of Agriculture, Washington, D. C., was elected an active member, and the following were elected corresponding members: Prof. J. W. Jenks, Brown University, Providence, R. I.; T. D. A. Cockerell, Institute of Jamaica, Kingston, Jamaica; Miss E. A. Ormerod, St. Albans, England; W. Julich and A. Luetgens, New York city; Prof. S. A. Forbes, John Marten, and C. A. Hart, Champaign, Ill.; Prof. C. W. Hargitt, Syracuse, N. Y.; Prof. T. Thorell, Montpelier, France; Prof. W. Kulszynski, Cracow, Austria; A. D. Hopkins, Morgantown, W. Va.; and Dr. F. W. Goding, Rutland, Ill.

Mr. A. D. Hopkins, Entomologist of the Agricultural Experiment Station, at Morgantown, W. Va., was especially invited to speak upon the subject of a recent trip to Europe for the purpose of studying certain Scolytidæ, and of introducing their European natural enemies into America, particularly for use against *Dendroctonus frontalis*.*

In the discussion of this paper, Dr. Riley stated that *D. frontalis* seems to be rapidly on the increase in this country. In answer to a question by Mr. Hopkins, Dr. Riley stated further that there would probably be no harm from the introduction of *Clerus formicarius*, of which Mr. Hopkins had brought over about one thousand living specimens. He thought it quite likely that this species would gradually replace some of our allied native species of similar habits, but that no harm would result. He was of the opinion, however, that better success could be obtained by intro-

* The substance of Mr. Hopkins' remarks is published in *Insect Life*, Volume V, No. 3, pp. 187–9.

ducing natural enemies which have no close relatives in this country.

Mr. Howard, in answer to another question by Mr. Hopkins, stated that, in his opinion, several of our American Braconids would be likely to attack the introduced European Clerus.

Mr. Marlatt asked whether the European species is not more active than our native Thanasimus. Mr. Hopkins stated that it is much more active. He stated that he had found it feeding upon five different species of European Scolytids, and that since his arrival in this country he had observed it feeding in confinement upon Dendroctonus. He exhibited specimens of living *Clerus formicarius*, and the members of the Society were fortunately able to watch one of these beetles feeding upon a Scolytid with which Mr. Hopkins had enclosed it.

Mr. Ashmead presented the following paper:

NOTES ON THE EUCHARIDS FOUND IN THE UNITED STATES.

By Wm. H. Ashmead.

Since becoming better acquainted with that great complex of the Hymenoptera, at present known to us under the family name *Chalcididæ*, I have gradually come to the conclusion that instead of a single family to deal with we have several distinct families.

Indeed, in many cases, these families are even more distinct and sharply separable than many other of the so-called families in this order; and, until these are properly separated and defined, I believe but little real progress can be made in our systematic knowledge of the Chalcidoidea.

It is not my intention now to go deeply into this subject, but to call attention to one group that I believe should be elevated to family rank, and to make some notes on the species found in the United States.

This group is the sub-family *Eucharinæ*. It is represented both in Europe and North America by but few species, although in warmer climes the species become quite numerous. In South America, Africa, Asia, and adjacent Isles, however, it is well represented, and by some forms that appear to be the most unique and wonderful to be found amongst the Hymenoptera.

I hope soon to be able to contribute a paper on their structure

and classification, and have here merely brought together a few of my notes relating to the species found in our fauna.

ORASEMA Cameron.

In this genus two specimens have been described, as follows:
1. *O. violacea* Ashm. Ent. Am., Vol. III (1888), p. 187.
Hab.—Fla.

2. *O. minuta* Ashm., l. c. p. 188.
Hab.—Fla.
To these I now add a third species from California.

3. *O. occidentalis* sp. n.

♀.—Length, 2.5 mm. Dull bronzy green, closely, finely punctate, the head of a brighter metallic green; scape, trochanters, tips of femora, tibiæ and tarsi, pale brownish-yellow; flagellum black, the joints after the first quadrate: mandibles brownish. Thorax not very gibbous; the collar is not visible from above; the mesonotum trilobed, the furrows punctate, the lobes convex; scutellum rounded, elevated posteriorly and with a transverse furrow before the tip, while the metathorax slopes obliquely off posteriorly with lateral sulci. Wings hyaline with brownish nervures; the marginal nervure is long, two-thirds the length of the subcostal, the stigmal minute, the postmarginal developed. Abdomen æneous, the petiole short, stout, finely rugose, one and a half times as long as thick, or as long as the hind coxæ, and metallic green; body of abdomen subtriangular, sulcate above at base.
Hab.—Los Angeles, Cal.
Type in National Museum.

Described from a single specimen collected by A. Koebele.

CHALCURA Kirby.

(1) *C. gibbosa* Prov.
Eucharis gibbosa Prov., Pet. Faune Ent. du Can. II, p. 591.
Hab.—Canada and United States.
This species was described by Provancher, from a female specimen taken in Canada, but the discovery of the male shows that it does not properly belong to the genus *Eucharis* as now restricted, and that it must be relegated to *Chalcura*, the antennæ in this sex being ramose.
Although rare, the species extends from Canada to Texas.
In the National Museum there is a second species closely allied, but evidently distinct, that may be described as follows:

(2) *C. californica* sp. n.

♂.—Length, 3.5 mm. Black, coarsely rugose; frons with coarse longitudinal grooved lines; face below antennæ transversely striate; scape, pedicel, and legs, except the coxæ, brownish-yellow; coxæ and flagellum black; femora obfuscated toward base. The flagellar joints after the third are broken, but each of those present is furnished with a branch longer than the scape. Thorax high, gibbous, more elevated than in *C. gibbosa* Prov.; the metathorax with a depression on each side. Wings hyaline; the tegulæ and the base of the subcostal nervure brownish. Abdomen clavate, polished black; the petiole long and slender, as long as the body of abdomen, and finely striate.

Hab.—Santa Cruz Mts., Cal.

Type in National Museum.

Described from a single specimen collected by A. Koebele.

Stilbula Spinola.

(1) *S. montana* Ashm. Bull. No. 1, Col. Biol. Assoc. 1889, p. 24.

Hab.—West Cliff, Col.

Up to the present time the above species, collected by Mr. T. D. A. Cockerell, is the only species known in our fauna.

Metagea Kirby.

In this genus only a single species is known, *M. zalates* Walker, from Australia.

To this I now have the pleasure of adding a second species, collected by Mr. E. A. Schwarz in Maryland and the District of Columbia.

(2) *M. schwarzii* sp. n.

♂ ♀.—Length, 1.5 to 2 mm. Black; antennæ fuscous, the pedicel beneath yellowish; legs, except coxæ, brownish-yellow, the femora toward base, especially the hind pair, sometimes obfuscated; coxæ black; wings hyaline, with a subobsolete cloud beneath the stigma. The head, except the stemmaticum, and the thorax except anteriorly, smooth, polished, impunctate; the parapsidal furrows and a central furrow feebly defined by minute punctures; scutellum, conical, convex, with a longitudinal central furrow, and the apex margined but not bidentate; pleura and metathorax rugose. Antennæ 11-jointed, in ♀ subclavate, scarcely reaching to the tegulæ, the scape and pedicel very short, the first funiclar joint being the longest joint and as long as the two former united, the following joints gradually shortened towards the apex; in ♂ filiform, longer, reaching to the metathorax; the third joint also the longest, but the following are twice as long as thick.

Hab.—District of Columbia and Maryland.

Types in Coll. Ashmead.

LOPHYROCERA Cameron.

(1) *L. nigromaculata* Cam. Biol. Centr. Am. Hym., p. 104, pl. v., fig. 10.

Hab.—Nicaragua and Arizona.

A single specimen of this species was recognized in the Collection of the American Entomological Society collected in Arizona, and is an interesting addition to our fauna.

(2) *L. floridana* Ashm. Ent. Am., vol. iii, p. 187.

Hab.—Florida.

The type of this species is in my collection, although the National Museum contains a second specimen collected by Mr. E. A. Schwarz in Florida.

To these I now add a third species collected by A. Koebele in the Santa Cruz Mountains, in California.

(3) *L. apicalis* sp. n.

♀.—Length, 4 mm. Æneous black, coarsely rugose; frons with longitudinal striæ; face below antennæ transversely striate; scape, pedicel, and two apical joints of antennæ brownish-yellow; legs, except coxæ, pale brownish-yellow; coxæ black; femora toward base dusky. The flagellar joints, after the first, widen out toward the apex, the 5 or 6 terminal joints being obliquely directed. Thorax very high, gibbous, the scutellum terminating in two prongs that are scarcely one-third as long as the scutellum, while the metathorax has a tooth like projection on each side. Wings hyaline, the tegulæ and venation pale ferruginous or yellowish, the stigmal vein rather long, two-thirds the length of the postmarginal. Abdomen oblong, very slightly compressed, with the petiole moderately stout, nearly as long as the hind femur and coarsely rugoso-punctate.

Hab.—Santa Cruz Mountains, Cal.

Type in National Museum.

Described from a single specimen.

KAPALA Cameron.

(1) *K. floridana* Ashm. Thoracantha floridana Ashm., Ent. Am. i, p. 96, ♂. Proc. Ent. Sec. Acad. Nat. Sc., Phila., 1885, p. xi, ♂♀.

Hab.—Florida.

The genus *Thoracantha* Latreille, as now restricted, will contain only *T. latreillei* Guér., and all the species described as such must now be relegated to other genera.

T. floridana belongs to the above genus.

The opportunity is here taken advantage of to describe a Cuban species in the Collection of the American Entomological Society, which will probably be found to occur in South Florida.

It is closely allied to *K. furcata* Fabr., but presents some differences from my specimens of this South American species that I believe entitle it to a separate specific name.

K. terminalis sp. n.

♂.—Length, 4 mm. Metallic bronze green; scape, pedicel, legs, except the æneous or metallic coxæ, and abdomen except the petiole and the second segment above, pale brownish-yellow; flagellum brown-black with 9 very long, nearly equal branches; frons longitudinally striate, the face transversely striate. Thorax very high, transversely striate, the mesonotum and scutellum longitudinally striated; processes of the scutellum as long as the abdomen, purplish, finely longitudinally striate. Wings hyaline; the tegulæ and venation yellowish. The abdominal petiole is very long and slender, fully as long as a hind femur, blue-black and finely striate.

Hab.—Cuba.

Types in Coll. American Entomological Society.

Described from 4 badly broken specimens. Comes nearest to *Kapala* (*Thoracantha*) *furcata* Fabr., but of a brighter metallic color, the antennæ and the color of the abdomen being different.

In discussing this paper Mr. Howard asked concerning the exact evidence of the parasitism of certain of the Eucharidæ upon ants. Mr. Ashmead replied that absolute observations had been made in Australia and had been recorded by Forel. The Eucharidæ issued from the pupæ of the ant. Mr. Howard stated that if such an observation had actually been made the matter must be considered as settled, but that he had previously doubted this parasitism for the reason that some of the Eucharidæ are almost too large to be ant parasites. He had suspected that they might be parasitic upon some inquilines in ants' nests. He mentioned the fact that in the collection of St. Vincent Chalcids sent to Prof. Riley from Cambridge University there is a specimen of *Kapala furcata* Fab., which bears in its jaws a medium-sized red ant. He also called attention to the fact that probably the first Eucharid exhibited in this country was shown to this Society at its second meeting, June 5, 1884.

Dr. Riley dissented from Mr. Ashmead's conclusion as to the family rank of this group, and expressed the opinion that it should still be retained as a sub-family of the Chalcididæ.

Professor Riley then presented the following paper:

IS MEGASTIGMUS PHYTOPHAGIC?

By C. V. Riley.

I have recently received a very interesting letter from a valued correspondent, Mr. Herman Borries, of Copenhagen, Denmark, which hardly admits of abbreviation and which conveys sufficiently important information to justify, with the author's permission, its translation for publication:

During the years 1886 and 1887 the seeds of the Fir (*Abies pectinata* D. C.) in the forests of Denmark were destroyed so thoroughly that not a single healthy seed could be found. Cones which in 1887 were sent to me for examination did not show anything peculiar externally, but the apparently healthy seeds contained each a small larva of a Pteromalid of the family Torymidæ. This larva had dorsally seven small tubercles *from between* the segments and which serve for locomotion.

From two tons of cones kept in cages only a single species of Torymids developed from this larva in the spring of 1888, viz., *Megastigmus strobilobius* Rtzb., which had been entirely lost sight of since the time of Ratzeburg. Dr. Gustav Mayr, of Vienna, has confirmed the correctness of this determination; the species had hitherto remained unknown to him. The imagos appeared in thousands of specimens, but exclusively females, and not a single other insect was bred which could give any clew regarding the host.

Next year (1888) the seeds were perfectly healthy and the destroyer could not be found.

To the German forestry entomologists the matter remains a mystery, and in the literature I fail to find anything on the subject. The host I suppose to be a still undescribed species of *Grapholitha*. The *Megastigmus* is herewith sent under number E.

At the seed dealers I found the same *Megastigmus* [illegible] Germany, but also here no trace of [illegible] found.

I had occasion to examine the seeds of [illegible] can species of Fir trees and found [illegible] sometimes in large numbers [illegible] These seeds were collected [illegible] in the Sierra Nevada [illegible] were kept in glass jars and [illegible] tion. During the [illegible] the seeds and [illegible] Diptera issued from the seeds [illegible] ception not a single other insect [illegible] found.

It is worthy of mention that [illegible] seeds could not be obtained [illegible]

they "were destroyed by a worm." Thus, also, in this case the parasites appeared in the year following a general attack.

Since these Torymids dwell on the tops of the forest trees in the mountains, I presume they still remain undescribed and unknown, and I take the liberty of transmitting to you this material.

If the seeds are opened in the fall the Megastigmus larva is still found feeding on the germ of the seed, but in Torymid larvæ this is frequently the case after the host has been completely devoured, and no conclusions should be drawn therefrom regarding an exclusively phytophagic habit.

With the letter Mr. Borries sent an interesting series of specimens, duly lettered and numbered, as per the following list, which I present as part of the communication; the Roman numerals referring to the quills in which the specimens were sent:

MEGASTIGMUS DALM.

A. Very handsome species marked with black, red, and yellow. II and V, from *Abies magnifica* and *concolor*, somewhat smaller and paler; III, from *A. grandis*, distinctly smaller, much paler; IV, from *A. amabilis*, larger and darker. ♂ and ♀ of all varieties.

B. Entirely yellow species, also variable; perhaps two species mixed. I, from *Pseudotsuga douglasii*, ♂ and ♀; II, from *Abies magnifica*; III, from *A grandis*; IV, from *A. amabilis*; V, from *A. concolor*.

C. Very small, dark species, very similar to small specimens of the European *M. strobilobius*. From *Tsuga hookeriana*, 2 ♀♀.

D. Entirely black species from Japan. From *Abies mariesi*, 2 ♀♀.

E. *M. strobilobius* Ratzeb. from Denmark, 5 ♀♀. (♂ still unknown.)

The species marked "A" is evidently *Megastigmus pinus* Parfitt, while the other species are evidently undescribed. Mr. Borries' communication reopens the interesting question as to whether this genus Megastigmus is really phytophagic or not. As I have always been deeply interested in the exceptional phytophagic habit of species or genera in essentially parasitic families, I have looked into the literature on the subject, which may be summed up as follows:

Mr. Edward Parfitt, 4 Weirfield Place, St. Leonard's, Exeter, England, February 10, 1857, in a short article entitled "Description of a new Hymenopterous insect found amongst seeds of various species of Pinus from California," published in The Zoölogist, Vol. XV, p. 5543, describes a species of Megastigmus under the name of *M. pinus*, of which he says:

"The insect I am about to describe was found amongst the seeds of *Picea bracteata* and a new species of *Thuja*, and in *Pinus nobilis*, etc. The insect appears to be parasitic on some species of Cynips; at least I consider it to be so. I have several pupæ of the Cynips (if Cynips it be), but they are not far enough

advanced to determine that point; I am trying to rear them, and if I succeed I will make it known through the pages of The Zoölogist. The Chalcis is a very beautiful one and appears to retain its colors after death; the insect is a female; the male I have not been able to meet with, and if the males are as rare as those of our *Callimome devoniensis*, it is not very likely I shall be able to see them. The insect belongs to the genus Megastigmus of Dalman; there are but few species belonging to the genus known. I therefore consider this a very interesting addition, and as it appears to be generally attached to the Pinus family, I shall call it *Megastigmus pinus*."

Dr. Gustav Mayr in his "Die europäischen Torymiden," Vienna, 1874, records the following respecting the habits of the European species of Megastigmus:

(1) *M. synophri* Mayr....Bred from the Cynipid gall *Synophrus politus*.

(2) *M. stigmaticans* Fabr.(= *stigma* Nees. and *giganteus* Walk.) reared from Cynipid galls: *Aphilothrix lucida*, *Cynips argentea*, *C. calicis*, *C. caput-medusæ*, *C. glutinosa* and *C. kollari*.

(3) *M. dorsalis* Fabr.....(= *Bohemani* Ratz. and *xanthopygus* Foerst.) reared from Cynips galls: *Andricus inflator*, *A. noduli*, *A. singularis*, *A. terminalis*, *A. multiplicatus*, *A. cydoniæ*, *A. grossulariæ*, *Aphilothrix gemmæ*, *A. lucida*, *Dryophanta macropteba*, *Cynips caput-medusæ*, *C. conglomerata*, *C. coriaria*, *C. glutinosa* var. *coronata*, *C. lignicola*, *C. polycera*, *Spathegaster glandiformis* and *Synophrus politus*.

(4) *M. collaris* Boh.......(= *transversus* Walk., = *punctum* Foerst., *vexillum* Ratz., = *flavus* Foerst.) reared from *Trypeta continua* Meig. infesting Rosa fruit.

(5) *M. pictus* Först.......(= *strobilobius* Ratz.) reared from the cones of *Abies excelsa*. Mayr further remarks that these cones were probably infested with the larvæ of *Tortrix strobilana*.

(6) *M. bipunctatus* Boh...(= *erythrothorax* Nees.) reared from the larvæ of *Laverna epilobiella* and *Hypsolophus marginellus.*
(7) *M. brevicaudis* Ratz..Reared by Bouché from the berries of *Sorbus aucuparia.*
(8) *M. pistaciæ* Hal. (Walk.)Reared from *Pistacia lentiscus* and *P. terebinthus* (? seeds).

Finally, Fritz Wachtl, in the Wiener Entomologische Zeitschrift, 1884, pp. 38–'9, records *Megastigmus collaris* Boh. from the seeds of roses in which the larva was observed without trace of any host larva, and in a later article he claims the same phytophagic habit for *M. pictus.*

In the U. S. National Museum there are but two species of the genus, both of them undescribed, viz:

(1) *Megastigmus* n. sp.....This is represented by one male and two female specimens from J. L. Zabriskie, Nyack, N. Y., Feb. 6, 1884. It was reared from the Cynipid gall *Callirhytis scitulus* Bassett.
(2) *Megastigmus* n. sp.....Represented by one male and one female specimen reared by Miss Mary E. Murtfeldt, Kirkwood, Mo., Oct. 18, 1881, from the seed capsule of *Physocarpus opulifolius.*

From this record it will be seen that there is every reason to conclude that the genus is essentially parasitic, chiefly upon gall-making Cynipidæ; but the circumstantial facts communicated by Mr. Borries, connected with the species inhabiting the seeds of conifers, as well as Wachtl's observations, certainly justify the presumption that some of the species of the genus may be phytophagic. It would indeed be remarkable that the host in such a large number of seeds as that examined by Mr. Borries should have been so invariably destroyed that only a single Cecidomyid larva was found, and this may have been entirely independent of any connection with the Megastigmus.

I do not overlook the fact that, in his paper on the Biology of the Chalcididæ (Proc. U. S. Nat. Mus., Vol. XIV, p. 586), Mr. Howard, in discussing Wachtl's observations in reference to Megastigmus, considers them inconclusive, but the other facts presented herewith certainly strengthen the presumption of phytophagism.

I present the facts recorded, however, not as an actual solution of the question, but in the hope of drawing the attention of entomologists to the subject, and inducing those on the Pacific coast who have the opportunity to try to settle the question, which can be easily done by watching the oviposition of Megastigmus or by tracing the different stages of the larva. I will simply venture the opinion that, however much it may conflict with the unity of habit in the same genus, I see nothing at all improbable in this diversity of habit, since we already know that the phytophagic and entomophagic habits obtain in very closely allied genera in the same family.

In discussing this paper Mr. Howard stated that it was his opinion that the phytophagic habit of Megastigmus was not proved even by this strong evidence. The case of the Danish fir seeds he thought to be simply a very complete instance of parasitism comparable to many which Prof. Riley himself must have witnessed, and considered that the very fact that the following year the seeds were perfectly healthy and the destroyer could not be found was almost a certain proof that the insects appearing in such large numbers were parasites and not plant feeders—in other words, that the true plant feeders had been almost completely killed off. With regard to the observation as to the actual feeding of the torymine larvæ upon the germ of the Oregon seed, Dr. Borries himself gives the proper explanation, that this only occurs after the host larva has been completely devoured. The fact that a single Dipteron was reared from these seeds is significant, as well as the statement that the previous year the seeds were "destroyed by a worm." There is no indication that the worm of the previous year was a Megastigmus larva, and the presumption is that it was not. He mentioned the cases of *Eurytoma funebre* and *Tanaostigma coursetiæ* as two instances where his own careful dissections had failed to show any sign of a host larva at first, and only some time later was the true host discovered. In both of these instances he considered the proof of the phytophagic habit as strong as that adduced by Wachtl and as strong as that of the second case mentioned by Borries, yet it is now known that the first of these parasites feeds upon *Cecidomyia leguminicola* and the second upon a small Curculionid larva. He stated that where an observation so distinctly negatives every-

thing which has been established concerning the habits of a restricted group, the fullest proofs should be demanded.

In reply, Prof. Riley stated that the very arguments which Mr. Howard brought out were the ones which had been adduced by English observers and others against the phytophagic habit of Isosoma which has since been so surely proved. The dearth of infested seeds the second year with the Danish fir cones might be the result of dimorphism or alternation of generation in the species, the bisexual generation having a different habit, and this view is supported by the fact that all of the specimens bred by Mr. Borries in 1887 were females. In his opinion the actual feeding of the larvæ of the Megastigmus upon the germ of the seed of the Oregon Pine is positive proof of a partial phytophagic habit, and in connection with many facts in reference to the question of inquilines would suggest that perhaps the true explanation is to be found in the combination of the parasitic and phytophagic habits in many genera of the true parasitic families. It is quite likely, in other words, that in these parasitic Hymenoptera we have a case quite similar to that of some of the partially parasitic bees and beetles, viz., that the young larva, after first partaking of the egg or the larva of its host, feeds on the vegetable food stored up by the host parent. In other words, Megastigmus may first feed on the seed-infesting larva and after destroying it may feed upon the seed itself.

Prof. Riley then read the following:

NOTE ON GALERUCA XANTHOMELÆNA.

By C. V. Riley.

Prof. John B. Smith at New Brunswick, N. J., and myself here at Washington have taken particular pains the present year to ascertain definitely the number of generations of *Galeruca xanthomelæna* that occur in our respective localities, and at the late meeting of the Entomological Club of the American Association for the Advancement of Science our conclusions were presented, the observations in either case being so carefully made that there could be no doubt as to their accuracy. The results showed that the species is single-brooded at New Brunswick, and double-brooded here at Washington, with a tendency to a third and even a fourth generation. I have had considerable correspondence with Mr. Smith on the subject, and present for record the following letter from him, which explains itself, and which

shows that I was justified in my surmise that there would be an exceptional tendency to a second brood even at New Brunswick:

NEW BRUNSWICK, N. J., *August* 31, 1892.

DEAR DR. RILEY: I wrote you this morning and did not intend writing you again to-day, but I cannot resist the temptation of giving you a chance to say "I told you so." I have to-day—since writing you this morning—discovered here and there patches of eggs of *G. xanthomelæna* and one brood of newly-hatched larvæ, on the new foliage of the elms. The parent beetles are the results of the latest larvæ of the first brood, and there are very few of them about. I will have to be away for the next few days, but I will have some of the beetles collected and prepared for study. It is due to myself to say that I found nothing of the kind in previous years, and due to you to say that facts have verified your suggestion, that, with abundant fresh food, some of the beetles would exceptionally produce a second brood, as in Washington they exceptionally produce a third. It is a remarkable fact that from early in July until late in August no eggs should have been seen, while now (August 31, 1892), quite suddenly, there is no difficulty in finding them, though they are by no means abundant. How are they with you?

Sincerely yours,

JOHN B. SMITH.

Prof. Riley also remarked upon the injury done this year by Elaphidion. While travelling between Philadelphia and New York he had noticed that the oak forests were damaged by the breaking off of the branches, much as though a brood of *Cicada septemdecim* had been present early in the season. An examination by Prof. Smith, however, indicated that this damage was done by an Elaphidion and not by Cicada. The effect was so similar that any one might easily be mistaken without close examination. Mr. Hopkins stated that he had seen a very similar condition caused in the forests of West Virginia by twig-girdlers.

Mr. Ashmead exhibited the drawings for his plates illustrating his forthcoming monograph of the Proctotrypidæ of North America. Mr. Heidemann exhibited a series of specimens of *Rheumatobates rileyi* which he had recently taken in the vicinity of Glen Echo, in the clear water of the canal, in certain restricted localities. Up to that time he had captured 14 females, 6 males, and about 80 larvæ and pupæ. He also exhibited a drawing of the female. He stated that up to this time the only specimen

known was a single male captured by the Rev. J. L. Zabriskie, Flatbush, Long Island, N. Y., and which is figured in *Insect Life*, Vol. IV, p. 199.

NOVEMBER 3, 1892.

President Riley in the chair. Eleven members present.

The Corresponding Secretary presented on behalf of the author the following paper:

SUMMARY OF THE COLLECTION OF HEMIPTERA SECURED BY MR. E. A. SCHWARZ IN UTAH.

By P. R. UHLER.

The collection of Hemiptera here enumerated is one of the most comprehensive and important that has ever been brought together from a limited area of a single Territory of the United States. It by no means represents the fauna of an entire district, nor even of that district for a single year; but it does show how rich the fauna of Utah may be, and how much more is yet to be discovered when the country is explored throughout the seasons and during a term of years. It would be but mere speculation to assume that we have yet seen much more than one-fifth of the great assemblage of forms which belong to this Territory. From ordinary analogy, however, we may fairly infer that as yet only a small proportion of the species belonging to any of the families of Hemiptera resident there have been brought to notice. As usual, the CAPSIDÆ form the largest division of the assemblage, being represented by 35 species; next come the LYGÆIDÆ with 16 species; the PENTATOMIDÆ follow with 15 species; and after these the smaller families, COREIDÆ with 8 species, ANTHOCORIDÆ with 8 species, SALDÆ with 6 species, TINGIDÆ with 4 species, ARADIDÆ with 3 species, REDUVIIDÆ with 5 species, SCUTELLERIDÆ with 3 species, CORISÆ with 3 species, and the HYDROBATIDÆ with only 1 species.

Taken alone, this collection, made during the short time from June 13 till July 4, 1891, would give a false impression of the Heteropterous fauna of Utah. Multitudes of the species already known from Colorado extend across the boundaries of these political divisions, and accordingly the families VELIIDÆ, GALGULIDÆ, NAUCORIDÆ, BELOSTOMATIDÆ, NEPIDÆ, and NOTONECTIDÆ must not be omitted from a correct enumeration.*

* Mr. Schwarz furnishes the following information regarding the localities mentioned in this paper:

The Homoptera collected during this excursion are too few in number to offer satisfactory suggestions as to the character of this fauna, so that a summary of this branch of the subject must be deferred until a later occasion offers more adequate knowledge.

SCUTELLERIDÆ.

1. *Homœmus bijugis* Uhler. Hayden, Geol. Surv. Montana. p. 393.

Six specimens were in the collection sent to me for examination. They were variable both in size and pattern of marking, and they were all secured at Wasatch, June 27, 1891.

2. *Corimelæna extensa* Uhler. Amer. Ent. Soc. Proceed. 1863, p. 155.

Five specimens were collected at Ogden, Utah, July 3, 1891.

3. *Eurygaster alternatus* Say. Amer. Entom., vol. 3, pl. 43, fig. 3.

Numerous specimens of several varieties were collected near Great Salt Lake and at Wasatch from June 15 to June 27, 1891.

PENTATOMOIDEA.

1. *Zicrona cuprea* Dallas. Brit. Museum List. Heteropt., v. 1, p. 108, No. 2.

One specimen of the narrow and bronzed variety from Alta, June 30.

2. *Melanæthus elongatus* Uhler. Hayden, Bull. U. S. Geol. Surv., v. 2, No. 5, p. 14.

One specimen from American Fork Cañon, June 21.

3. *Pangæus bilineatus* Say. Phila. Acad. Nat. Sci. Jour. iv; 315, No. 1.

Two specimens of small size from Wasatch, June 27.

4. *Prionosoma podopioides* Uhler. Entom. Soc. Phila. Proc., v. 2, 1863; p. 364.

One specimen from Pueblo, Col., but the species occurs also in Utah.

Alta—Alpine region of the Wasatch mountains; altitude 9,000-10,000′.
American Fork—Desert land in the vicinity of the town; altitude 4,600′.
American Fork Cañon—Lower part of the cañon; altitude 5,500-6,000′.
City Cañon—Lower part of the cañon; altitude about 4,500.′
Great Salt Lake—Southern and eastern shores of the lake, and adjoining desert land; altitude 4,200′.
Mill Creek—Within the irrigated district near Salt Lake City; altitude about 4,400′.
Ogden—Near the mouth of Ogden Cañon; altitude 4,500′.
Park City—Almost within the alpine region; altitude 7,500-8,000′.
Utah Lake—Swamps near American Fork, on the eastern shore of the lake; altitude 4,500′.
Wasatch—Within the mouth of Little Cottonwood Cañon; altitude 5,500′.

5. *Brochymena obscura* H. Schf. Wanz. Ins., vol. 5, p. 68. fig. 513.

Two specimens from American Fork Cañon, June 23; one from Mill Creek, June 17; and another from near Utah Lake. June 26.

6. *Carpocoris lynx* Fab. Entom. Syst., p. 110, No. 118.

One specimen of small size from Wasatch, June 27.

7. *Euschistus servus* Say. Heteropt. New Harmony, p. 4, No. 5.

Two specimens from Wasatch, June 27.

8. *Thyanta custator* Fab. Syst. Rhyng., p. 164. No. 43.

One specimen from vicinity of Great Salt Lake, June 13, and three others from Wasatch, June 27.

9. *Thyanta rugulosa* Say. Heteropt. New Harmony, p. 7. No. 16.

Four specimens from near Great Salt Lake, June 14, and July 4; also one from the American Fork Cañon, June 23, and another from Alta, July 1.

10. *Lioderma congrua* Uhler. Hayden, Bull. U. S. Geol. Surv. 1876, p. 22, No. 2.

One specimen from Alta, June 29, and another from Wasatch, June 27.

11. *Lioderma sayi* Stal. Enum. Hemipt., v. 2, p. 33, No. 6.

Four specimens from near Great Salt Lake, June 15 and 23.

12. *Lioderma ligata* Say. Heteropt. New Harmony, p. 5, No. 6.

Two specimens from the American Fork Cañon, June 23.

13. *Nezara hilaris* Say. Insects of Louisiana, p. 9.

One specimen from the American Fork Cañon, June 26, and another from City Cañon, June 23.

14. *Neottiglossa sulcifrons* Stal. Enum. Hemipt., v. 2, p. 18, No. 2.

Two unusually large and dark specimens were secured at Wasatch, June 27.

15. *Eysarcoris intergressus*. New sp.

Form of *Eysarcoris melanocephalus* Fab., but with a more quadrilateral and regular head. Ground color dull fulvous, clouded with slightly darker patches on the upper surface; the head, callosities and disk of venter more polished than other parts. Upper side of head bronzed blackish, coarsely irregularly punctate, with the lateral lobes broad, indented next the end of the tylus, and a little longer than that member, also a little widened near the tip and with the outer angles a little rounded; the rostrum slender, flavo-testaceous, piceous at tip, reaching behind the posterior coxæ; antennæ flavo-testaceous, piceous at base and on most of the apical joint, basal joint stout, not quite reaching the tip of head, second and third joints longer, subequal, the fourth a little longer, all the joints clothed with stiff

pubescence. Pronotum moderately convex, with a sunken dot each side of middle of disk, and an indented spot on the same transverse line nearer the outer border, the callosities and anterior corner bronze-black, lateral margins slender, strongly reflexed, pale anteriorly, the humeral angles normally prominent and rounded. Legs honey-yellow, pointed and sprinkled with piceous, the posterior femora with an uneven piceous band near the tip. Pleural and epipleural segments black, polished, punctate. Scutellum moderately convex, mottled with brown, wrinkled, marked at base with a central yellow dot, and in each corner with a similar dot, and with a few vestiges of the same color across the suture and between the others, the punctures fuscous and becoming finer posteriorly. Hemelytra more coarsely punctate at base, tapering towards the apex and gently curved on the costal border, but strongly curved, and a little sinuated next the scutellum on the inner border; the membrane milky-whitish, with the veins pale piceous. Embolium and connexivum orange-yellow, the latter with a black dot on each of the segments. Venter blackish, polished, punctate, broadly bordered with yellow, and with one or two of the apical segments brighter yellow.

Length to end of venter 5½–6 millim; width across the humeral angles 3½–4 millim.

One specimen was taken in the American Fork Cañon, June 21. It is a female of somewhat larger size than others which I have seen, and which were collected in Kansas and California. This insect should not be confused with the dwarfed form of *Cosmopepla conspicillaris* Dallas, which it closely resembles. The latter has the joints of the antennæ chiefly black, the ridge across the pronotum is orange or reddish and polished, and the membrane is smoky brown.

COREIDÆ.

1. *Corizus hyalinus* Fab. Ent. Syst., vol. 4, p. 168, No. 115.

Two specimens from near Utah Lake, June 26.

2. *Corizus lateralis* Say. Phila. Acad. Nat. Sci. Journ., vol. 4, p. 320, No. 4.

Two specimens from the vicinity of Great Salt Lake, June 15 and 26.

3. *Corizus pictipes* Stal. Enum. Hemipt., vol. 1, p. 223; Fregat. Eugenie resa. Ins., p. 239, No. 48.

A male of the common variety was secured near Great Salt Lake, June 16.

This insect was separated from *C. sidæ* Fab. upon differences of color and pattern of marking, which are merely varietal. It is a most variable insect in size, color, and style of marking, the colors extending all the way from a pale green with gray and white spots and bands, to a bright orange with fuscous, black, brown, and white decoration.

4. *Corizus punctiventris* Dallas. Brit. Mus. List. Heteropt., vol. 11, p. 523.

Four specimens were collected at Wasatch, June 27.

It is the Canadian species which spreads from the province of Quebec across the region of the great lakes westward to the Pacific States and from thence keeps on all the way south into California and Northern Mexico.

5. *Corizus validus.* New sp.

This is more robust than any of the other species thus far discovered in North America. It is of a pale greenish testaceous color, closely whitish pubescent, remotely and minutely sprinkled with dark brown on the upper surface, and less distinctly so on the under surface, the legs also sprinkled, and each tarsal joint black at tip. Head a little longer than wide, the vertex and front coarsely punctate and wrinkled, closely setose-pubescent, back of head with a depressed longitudinal line, and the space between the eye and ocellus raised like a tubercle; rostrum reaching upon the posterior coxæ, marked with a piceous line throughout its length; antennæ stout, the basal joint a little dotted and streaked with black, the tip of the second and third joints and apical two-thirds of the fourth joint fuscous. Pronotum coarsely unevenly punctate with the intervals between the punctures swollen, surface each side of disk, posteriorly, convexly raised, humeral angles tubercular, bordered behind by a curved, pale lamella, the posterior submargin forming a curved ridge which is marked with brown spots, lateral margin bent down, the middle line unevenly sulcate and occupied by a slender, pale carinate line, the anterior margin depressed, bounded behind by a transverse ridge back of which the surface is thrice indented, and each anterior angle set with a tubercle. The scutellum subacute at tip, with the border upturned there, the base scooped out and bordered each side by a short callous ridge, the middle line obsoletely ridged, bounded each side by several lines of coarse punctures. Wing-covers pale testaceous, translucent, the veins marked with remote brown spots, the membrane milky-transparent, very obsoletely sprinkled with brown. Pleural pieces pale greenish, coarsely punctate, the mesopleura especially coarsely so. Venter polished, punctate, minutely sprinkled with brown, the tergum greenish, finely punctate, its disk marked with black areas of variable size, the middle ones being separated by slender cruciform lines of the ground color, the black marking either carried back from the large spot of the penultimate segment as a fusiform streak or divided into a series of geminate dots; connexivum with a small brown slender spot at the incisure between the segments. Length to tip of venter, $7\frac{1}{2}$–8 millim; width of base of pronotum, $2\frac{3}{4}$–3 millim.

Two specimens were secured near Great Salt Lake, June 13, and another at Alta, Utah, June 30, from an elevation of 10,000 feet above tide. It belongs to the group of *C. sidæ* Fab., but it is much stouter and larger. Specimens in my own collection

were captured in Oregon by Dr. G. H. Horn, and at Fort Tejon, Cal., by Dr. John L. LeConte.

6. *Corizus.* New sp.

A single specimen of a form closely related to *C. nigristernum* Signt. was captured at Alta, June 30. This individual specimen will not serve to adequately define the species, and so we leave it for description until a number of specimens shall have been secured.

7. *Harmostes reflexulus* Say. Heteropt. New Harmony, p. 10, No. 1.

Three specimens from Wasatch, June 27. This is a most variable species, which inhabits mountain, plain, or valley in almost every section of the United States.

8. *Leptocoris trivittatus* Say. Phila. Acad. Nat. Sci. Journ., vol. 4, p. 322, No. 2.

One specimen from Ogden, July 3.

LYGÆIDÆ.

1. *Nysius californicus* Stal. Eugenie Resa. Hemipt., p. 242, No. 5.

Numerous specimens were collected at various stations, such as Wasatch, June 27; American Fork Cañon, June 23; Alta, at 10,000 feet above sea-level, June 29, and near Great Salt Lake, June 13.

2. *Nysius angustatus* Uhler. Hayden, Geol. Surv. Montana, p. 406, No. 2.

Many specimens were secured at American Fork Cañon, June 23; near Great Salt Lake, June 15; at Alta, June 29, and at Wasatch, June 27.

3. *Nysius.* New sp.

A small form, apparently undescribed, was met with at Wasatch, June 27.

4. *Cymus luridus* Stal. Enum. Hemipt., vol. 4, p. 126, No. 1.

Three specimens were secured near Utah Lake, June 26.

5. *Cymus.* New sp.

Two specimens, probably new to science, were captured near Utah Lake, June 20.

6. *Cymodema tabida* Spin. Essai sur les Hemipt., p. 213.

One specimen was taken near Utah Lake, June 20.

7. *Crophius disconotus* Say. Heteropt. New Harmony, p. 14, No. 6.

Several specimens were captured near Utah Lake, June 20, and one was found at American Fork, June 24.

8. *Geocoris decoratus* Uhler. Hayden, Bullet. U. S. Geol. Surv., vol. 3, p. 410, No. 3.

Two specimens were secured near Great Salt Lake, June 25.

9. *Geocoris piceus* Say. Heteropt. New Harmony, p. 18, No. 1.

Two specimens of the black variety were collected near Great Salt Lake, June 25.

10. *Ptochiomera*. New sp.

One specimen, apparently new to science, was obtained at Wasatch, June 27.

11. *Emblethis arenarius* Linn. Fauna Succica, p. 955.

Several specimens of this common and widely distributed European insect were found near Great Salt Lake, June 25; near Utah Lake, June 20, and near American Fork, June 24.

12. *Eremocoris ferus* Say. Heteropt. New Harmony, p. 16, No. 4.

One specimen was taken at Wasatch, June 27, and another at Alta, June 30.

13. *Megalonotus sodalicius* Uhler. Wheeler, Geol. Surv. Zoöl., p. 835, pl. 42, fig. 2.

One specimen was obtained at Wasatch, June 27.

14. *Cryphula*. New sp.

The immature condition of this specimen renders the reference to this genus uncertain. It was taken near Mill Creek, June 16.

15. *Lygæus bistriangularis* Say. Heteropt. New Harmony, p. 14, No. 3.

One specimen, a variety, was taken at Wasatch, June 27.

16. *Lygæus bicrucis* Say. Phila. Acad. Nat. Sci. Journ., vol. 4, p. 322, No. 2.

Specimens were taken at Wasatch, June 27, and at Alta, June 30.

CAPSIDÆ.

1. *Trigonotylus*. New sp.

Only one specimen was taken. It was found near Great Salt Lake, June 15, and does not offer material sufficient for description.

2. *Clivinema villosa* Reuter. Ofver. of Kongl.Vetensk. Akad. 1875, p. 63.

Three specimens were captured on Bigelovia, near American Fork, June 22 and 24. They are exceptionally fine and well-marked examples of this remarkable insect. The genus is now seen to be represented in Massachusetts, Texas, and Utah.

3. *Lopidea circumcincta* Say. Heteropt. New Harmony, p. 23, No. 14.

One specimen from Ogden, July 3.

4. *Mimoceps gracilis* Uhler. Md. Acad. Sciences, Trans., 1890, p. 85.

Several specimens, with clear bright markings, were obtained near Utah Lake, June 26.

5. *Diommatus congrex* Uhler. Entom. Americana, vol. 3, p. 3.

One specimen from the vicinity of Mill Creek, June 16. This insect, hitherto known only from the eastern United States, adds another interesting form to the long list which is increasing as the western country is becoming investigated.

6. *Bolteria picta*. New sp.

Pale yellow, polished, striped with black. Head narrower than in *B. amicta*, and not so closely enclosing the front of pronotum as in that species, the vertex marked with two large and broad, but short black stripes, cheeks and exterior border of the tylus, as also rostrum and antennæ, black, the rostrum reaching to the middle coxæ. Pronotum transverse, minutely pubescent, moderately convex, strongly sloping anteriorly, the sides oblique, evenly bordered, the anterior submargin and the posterior border black. Scutellum black, transversely impressed at base, lobate behind this point, with an orange spot on each angle and at tip. Sternum black; legs and coxæ yellow, the tibial spines, long spots on the femora and the tarsi blackish. Wing-covers pale yellow, with the inner margin, very slender line on the outer border of the clavus, a gradually widening line on the middle and a narrower one next the costal border and an ovate spot on the cuneus shining black, the areole of base of membrane blackish, membrane a little tinged with fuliginous, and with a darker streak running back from the vein. Venter polished, black.

Length to tip of abdomen—♂ 3, ♀ 3¼ millim; width of base of pronotum, 1–1¼ millim.

Several specimens of this showy little insect were taken on *Artemisia tridentata* at American Fork, June 22, 1891.

It is a narrower and less robust form than *B. amicta*, and it has the exterior margin of the corium a little more curved.

7. *Stiphrosoma croceipes*. New sp.

Narrower and smaller than *S. stygica* Say. Highly polished, brilliant bluish-black, with the apical half of the femora orange-yellow. Head convex between the eyes, exceptionally high polished, not apparently punctate; antennæ long and slender, dull black, with the basal joint orange-yellow; rostrum piceous-black, reaching upon the middle coxæ; eyes projecting laterally as wide as the base of pronotum. Pronotum strongly convex, unevenly scabrous and punctate, with the callosities tumidly convex, and the anterior angles suborbicularly rounded, the lateral border bent down. Scutellum convex, minutely wrinkled, remotely punctate. Posterior tibiæ, spines of all the tibiæ, and all the tarsi piceous. Pleural flaps coarsely, obsoletely punctate. Hemelytra finely polished, coarsely punctate, the punctures more regular on the clavus, but obsolete on the distended disk of the corium; cuneus obsoletely punctate and feebly wrinkled; membrane smoke-brown, darker in the areole, and with a

whitish line next the cuneus. Venter polished, very indistinctly and remotely punctate.

Length to end of venter, 3 millim; to tip of membrane, 3½ millim; breadth of base of pronotum, 1¼-1½ millim.

The description is based upon two male specimens from Los Angeles, Cal., which were kindly sent to me by Mr. D. W. Coquillett. Several specimens were collected at American Fork, June 22.

8. *Lygus pratensis* Linn. Fauna. Suec., 949; Fabr. Syst. Rhyng., p. 234, No. 155.

This common European species is spread over the greater part of North America, including Mexico and Canada. It is also remarkably variable in size, form and colors. Several of its common forms were secured, in numbers, by Mr. Schwarz, at Salt Lake City, June 15; Wasatch, June 27; Alta, June 23; and near Utah Lake, June 26.

9. *Lygus*. New sp.

A single specimen, not enough for description, was obtained at Alta, June 30.

10. *Systratiotus americanus* Reuter. Ofvers. Kongl. Vetens.-Akad. Förhandl., 1875, p. 73.

Five specimens, including both sexes, were secured at Wasatch, June 27.

11. *Poeciloscytus unifasciatus* Fab. Entom. Syst., vol. 4, p. 187, No. 153.

One specimen was obtained at Wasatch, June 27. In Europe it occupies grassy spots in hilly places. It occurs abundantly in the province of Quebec.

12. *Capsus*. New sp.

A single specimen, unfit for description, was taken at Wasatch, June 27.

13. *Capsus*. New sp.

One specimen, unsuitable for description, was captured at Park City, June 17.

14. *Capsus*. New sp.

This was taken in the American Fork Cañon, June 23.

15. *Capsus*. New sp.

The single specimen, also captured in the American Fork Cañon, June 23, is unfit for description.

16. *Hadrodema pulverulenta* Uhler. Trans. Md. Acad. Sci. 1892, p. 183.

One specimen was taken near Utah Lake, June 26. It is a common species which is widely distributed on both sides of the continent. I have examined specimens which were collected in Mass., Conn., New York; New Jersey, P. Wild; Penna., York county, in gardens, on blossoms of Privet, *Ligustrum vulgare*

Linn; Illinois, by Mr. Stromberg; Rock Island, B. D. Walsh; near Evanston, Robert Kennicott; Kansas; Wisc.: Waco, Texas, Mr. Belfrage; Washington, D. C., June 7, O. Heidemann; Fredericksburg, Va., by myself; Georgia, near Atlanta, Mr. Morrison; Maryland, Anne Arundel and Prince George counties, June 5–10, by myself. This species is very near to *H. rubicunda* Fallen, and differs from it most in the proportion of the second joint of the antennæ. It is somewhat variable in depth of colors, but it has not been found of the rosy-red color common to specimens from Europe. It is generally of a pale dull fulvous color, with a whitish powdery aspect, caused by the flat, whitish pubescence, and the vein of the areole is also generally white.

17. *Camptobrochis schwarzii.* New sp.

Ivory yellow, highly polished, above conspicuously, sparsely punctate with brown; form a little less robust than that of *C. nebulosus*. Head highly polished, convex, crossed near the base by a curved brown band, the brown color spreading down each side of face and leaving an oblong oval pale spot on the middle, each side of tylus lineated with pisceous, sutures of the cheeks also pisceous; eyes dark brown; rostrum yellowish testaceous, piceous at tip, reaching between the middle coxæ; antennæ of normal length, and medium thickness, the basal joint usually dark at tip, the second with two dark bands, that of the apex darkest, the two apical joints united scarcely as long as the second one, infuscated except at the points of articulation. Legs honey yellow, minutely sprinkled with brown, the femora with two pisceous bands near the tip, and sometimes a little pisceous beneath, tibiæ also with two wider bands, the nails and tip of tarsi usually pisceous. Pronotum strongly convex, rather coarsely, unevenly, roughly punctate with pale brown, the callosities prominent, convex, either all black, or spotted with black or dark brown, the collum sharply defined, ivory white, preceded by a piceous border on the head, posterior margin white, sharply defined, obsoletely sinuated next the scutellum, the sides widely rounded off, sinuately bordered, with the lateral flap pale and carrying a pisceous spot behind the eye. Scutellum prominently convex, highly polished, ivory yellow, with a large, black, obconical spot running out from the base to next the tip, which is set with a very few coarse punctures. Beneath pale testaceous, becoming darker on the sides and venter, the prosternum with a small black spot in front of the anterior coxæ, back of this a black spot appears farther out next the meso-pleuron and from a series extends backward to the base of the ultimate segment of the venter. Hemelytra either ivory yellow, or pale testaceous, deeply somewhat irregularly punctate, minutely pubescent, convexly inflated in the middle, the punctures of the disk and behind being generally darker brown, the coarse pale vein of the corium callous on the middle and marked by a dark brown spot which often continues back in a streak to the inner corner of the cuneus; the cuneus pale, marked at tip with a dark brown spot; the posterior border of the corium is also some-

times brown; membrane faintly tinged with brown, vein of the basal areole interruptedly brown. Length to end of abdomen, 4-4½ millim; to tip of membrane, 5-5¼ millim; width of base of pronotum, 2 millim.

This pretty insect stands between *C. nebulosus* and *C. grandis*. It is variable in the amount and depth of dark marking of the surface, and that depends to some extent upon the maturity and vigor of the individual. Soft specimens are almost always paler and less extensively marked than those which are firmer and stronger.

Several specimens, mostly males, were captured at American Fork, June 22, 1891. I have examined others which were collected by Dr. Hagen near Ellenborough, on the Yakima river, Washington Territory, July 8, 9, 1882; and others have been in my possession which were brought from British Columbia by Robert Kennicott, and from other parts of the northwest territories of the United States by various persons.

18. *Phytocoris eximius* Reuter. Ofvers. Kongl. Vetens.-Akad. Förhandl., 1875, p. 67.

Three specimens were taken in the American Fork Cañon, June 23. The species is now known to have a very extended distribution. I have examined specimens which were collected in Massachusetts, New York, New Jersey, Pennsylvania, Maryland, North Carolina, District of Columbia, Virginia, Georgia, Florida, Texas, Arizona, and Northern Mexico.

19. *Orthotylus*. New sp.

One specimen from near Great Salt Lake, June 13. Not sufficient for description.

20. *Orthotylus*. New sp.

One specimen was taken in the American Fork Cañon, June 23. It will not admit of description.

21. *Psallus*. New sp.

A single specimen was obtained in the American Fork Cañon, June 23. It will not serve for correct description.

22. *Psallus*. New sp.

One specimen was secured at Wasatch, June 27. It will not serve for description.

23. *Asciodema inconspicua*. New sp.

Greenish-white, long and narrow, tender, dull, the upper surface with minute erect, black remote pubescence. Vertex a little yellow, transversely depressed above, followed below by the curved, impressed bounding line, and a longitudinal faintly impressed line on the middle, occiput carinate-ridged, front smooth, not apparently punctate, moderately convex; rostrum reaching between the middle coxæ, piceous at tip, the tylus stout and very prominent, antennæ long, the basal and second joints stout, more or less discolored, the second fuscous at base. Pronotum transverse,

parallel-sided, the lateral margins oblique, middle of the posterior submargin with two small, approximate, faint fuscous dots, the surface almost flat, but each side conspicuously set with stiff black short hairs. Scutellum feebly convex, pubescent, the middle line smooth, becoming wider on the tip. Sternum green, paler on the pleural areas. Legs pale yellowish-green, with the spines a little brown, and the nails piceous. Wing-covers flat, long, opaque, clothed with remote, erect, blackish pubescence, the color dull greenish; the membrane long, faintly tinged with fuliginous at base, and with the basal vein faintly brown. Venter green, with the connexivum paler.

Length to tip of venter, 2½ millim; to tip of membrane, 3½ millim; breadth of base of pronotum, about 1 millim.

Three specimens were collected near American Fork, June 22.

This is a delicate and flabby little insect, which can hardly be compared with any other species known to me. It is remarkable for the long, stout antennæ, which in some of the specimens are discolored almost throughout.

24. *Atomoscelis seriatus* Reuter. Ofvers. Kongl. Vetens.-Akad. Förhandl., 1875, p. 91.

Two specimens were secured near Great Salt Lake, June 13. This neat little species is now known from various parts of the South and West, and I have examined specimens from Maryland and the District of Columbia.

25. *Atomoscelis pilosulus.* New sp.

White, opaque, with a faint greenish or yellowish tinge, narrower than *A. seriatus* Reuter, the upper surface closely spread with white, silky pubescence which easily rubs off and leaves a polished surface. Head moderately convex. the face blunt, eyes pale brown, rostrum pale, piceous at tip, reaching behind the posterior coxæ. Antennæ moderately stout, the basal joint black, with a narrow whitish tip, the second blackish, somewhat testaceous towards the tip, third and fourth fuscous, in one specimen the apical half of the second joint is pale, and the two last joints are pale testaceous. Pronotum transverse, feebly convex, scutellum nearly flat, wing-covers long, flat, white; the membrane opaque, milk-white. Legs dull white, the knees, spines of tibiæ, and the fine dots at the origin of the spines black. Beneath dull white, the venter sometimes tinged with green.

Length to end of abdomen, 1¾-2 millim; to tip of membrane, 3-3¼ millim; width of base of pronotum, about 1 millim.

Several specimens were collected on *Bigelovia* near American Fork, June 22.

26. *Orthotylus.* New sp.

One specimen was taken in the American Fork Cañon, June 23, but it is not sufficient for description.

27. *Orthocephalus.* New sp.

A damaged specimen is in the collection from Wasatch, taken June 27. It is a pretty species, with red legs.

28. *Halticus Uhleri* Giard. Société de Biologie, Compt. Rend., 1892, 9 ser., v. 4, p. 81. *Halticus minutus* Uhler. Ms. Popenoe, Kans. Exper. Station. Second Annual Report, 1889, p. 212, pl. IX, figs. 10 and 12.

This species is now known to be widely distributed in the United States, and in many localities of Maryland, Virginia, and Pennsylvania it is extremely abundant upon cabbages in the gardens. It has been found a few times by the writer upon burdock, *Lappa major*, in the neighborhood of Baltimore. The leaves of this plant were almost covered by the great number of these little flea-like hoppers, which jumped off into the surrounding soil upon the lightest approach of the collecting net. It occurs fully winged in July, but the greater number of the females appear in the unfinished state which preserves the more robust and convex figure, with the short and completely coriaceous wing-covers. Other specimens in my collection were obtained at the following localities: Rock Island, Ill., B. D. Walsh; St. Louis, Mo., O. Lugger; Washington, D. C., and Berkeley Springs, Va., O. Heidemann; York county, Pa., F. E. Melsheimer; Egg Harbor, N. J., J. P. Wild; mountains of North Carolina, Dr. J. B. Bean; Orange Springs, Fla., Grimsby; Canada, J. Petit; Riley county, Kansas. E. A. Popenoe; American Fork Cañon, E. A. Schwarz. The name *minutus*, at first given to this species, is preoccupied by that of M. Reuter for a species found at Singapore.

29. *Agalliastes obliquus*. New sp.

Black, polished, form similar to that of *A. simplex*. Head wide, the eyes prominently projecting beyond the sides of the pronotum, occipital rim of head elevated, face highly polished, prominently convex; antennæ moderately long, black, the second joint thicker, but not as long as the third and fourth united; rostrum black at base and tip, piceous on the middle, reaching to behind the middle coxæ. Pronotum a little wider than long, minutely and obsoletely wrinkled, moderately convex, indented on the middle, the callosities like two geminate raised dots, the humeral angles prominently rounded, surface in front of the posterior margin sometimes marked with a lunate yellow spot; scutellum moderately convex, obsoletely wrinkled. Wing-covers dull black, minutely pubescent, and punctate, with a broad yellow stripe tapering backwards and occupying a large part of the clavus, margin of the corium broadly yellow, forming a stripe which widens behind and nearly covers the cuneus; membrane long in the male, shorter and wider in the female, pale, but marked from the base out with a dark cloud-like spot. Legs long, yellow, the posterior femora and all of the coxæ black, excepting tips of the latter, tarsi tinged with piceous. Beneath black, polished.

Length to tip of venter, 2-2¼ millim; width of base of pronotum, about 1 millim.

This novel and beautiful insect was found at Wasatch, June 27. The females are broader than the males, and, as usual, have the eyes less prominent and placed closer to the front of pronotum.

30. *Agalliastes uniformis.* New sp.

Black, highly polished, moderately flat, form of *A. associatus* Uhl., from which it differs chiefly in having a black rostrum and black legs. Hemelytra black, highly polished; the membrane smoke-brown, with the cell darker.

Length to tip of membrane, 2-2¼ millim; width of base of pronotum scarcely 1 millim.

Four specimens were secured, June 22, near American Fork, Utah.

31. *Agalliastes associatus* Uhler. Hayden, Report on Montana, p. 419.

This is a common species, of which specimens have been obtained at Ogden, Utah, also at Wasatch, June 27, in various parts of Colorado, as well as in New Mexico and in Texas.

It is possible that fresh specimens of this insect may show the silvery flecks common to other black species of a similar kind.

32. *Agalliastes stigmosus.* New sp.

Short and broad, flat, pale grayish, sparsely sericeous pubescent. Head smooth, yellow, vertex almost as wide as the front of the pronotum, very short, marked each side with a minute dot, and with a very slender black border behind; front tumid, chestnut brown, marked below with a black dot, the transverse suture and a small spot next the tylus black; rostrum reaching behind the middle legs, growing piceous from the middle to the tip; antennæ slender, yellow, the basal joints short, black, pronotum transverse, almost flat, yellowish white, smooth, with deflexed, oblique sides, marked anteriorly with a transverse brown line which is sometimes interrupted in the middle; sternum brown on the middle; pleural flaps opaque white, with a brown, raised dot just below the humerus. Legs dull white, sometimes a little brownish at the tip of the femora, the spines and most of the tarsi blackish. Scutellum almost flat, ivory white, transversed by a longitudinal brown streak, and with the basal angles and a geminate brown spot at base. Hemelytra obsoletely clouded with two brown streaks posteriorly, more distinctly pubescent than the pronotum, the caneus marked with a pale fuscous spot, and the membrane a little fuliginous in the areole. Tergum depressed, marked with black spots on the sides, posteriorly venter dull whitish, having an oblique dark stripe each side of the penultimate segment, a larger brown mark on the apical segment, the genital sheath of female and the minute inner angles of the connexivum more or less piceous.

Length to end of venter, 2¼ millim; to tip of membrane, 2¾ millim; width of pronotum, 1 millim.

This species is sharply marked by the brown bands and marks of the head, pronotum, and scutellum, and is well separated from the related species with a spot on the cuneus by its broader form. In the shape of its head, pronotum, and scutellum it bears some resemblance to the pale species of the genus *Geocoris* Fallen.

Specimens were collected at American Fork, June 22.

33. *Agalliastes decolor*. New sp.

Less robust than *A. stigmosus*, the male much longer and narrower than the female, beneath black, shining, above chiefly smoky whitish. Head blackish, having a yellowish brown band across the base of the depressed vertex; antennæ moderately long, black or fuscous; bucculæ and rostrum pale, the latter reaching to the posterior coxæ. Pronotum whitish testaceous, transverse, polished, not conspicuously pubescent, moderately convex, with the callosities prominent and sometimes discolored, the sides oblique. Scutellum with a broad blackish stripe on the middle, bounded at base with yellow. Legs black, the posterior tibiæ pale and set with black spines. Middle line of sternum pale piceous. Hemelytra narrow, translucent, finely pubescent, the cuneus marked with a triangular fuscous spot; the membrane faintly smoky, with the veins of the areole white. Abdomen polished black.

Length to end of venter, ♂ 2, ♀ $1\frac{3}{4}$–2 millim; to tip of membrane, ♂ $2\frac{1}{2}$, ♀ $2\frac{1}{4}$–$2\frac{1}{2}$ millim; width of pronotum, hardly 1 millim.

The delicacy and softness of the hemelytra suggest the inference that the four specimens observed are not mature. These were obtained at American Fork, June 22.

Other specimens of considerably larger size were collected by Mr. Coquillett near Los Angeles, Cal.

Two other species of Agalliastes were collected by Mr. Schwarz, the one at Mill Creek on June 16, the other at Salt Lake on June 13, but the specimens will not serve for description.

ACANTHIIDÆ.

1. *Piezostethus californicus* Reuter. Monog. Anthocor., 1885, p. 600.

One specimen was secured near Utah lake on June 20.

2. *Anthocoris* sp?

Two, or perhaps three, species of this genus were collected at Alta and Mill Creek on June 16, 29, and 30.

3. *Lyctocoris* sp?

Forms which appear to belong to two species were captured at Park City on June 17, and at Alta on June 29 and 30.

4. *Triphleps* sp?

Two species, may eventually prove to become new when more specimens are obtained, were collected, the one at American Fork on June 24, and the other at Wasatch on June 27.

TINGITIDÆ.

1. *Piesma* sp?

Specimens of one species were secured near Mill Creek on June 16, and another was captured in the American Fork Cañon on June 23.

2. *Corythuca fuscigera* Stal. Enum. Hemipt., III, p. 122, No. 1.

Specimens were found on a species of *Arnica* in the American Fork Cañon on June 23, and at Wasatch on June 27.

3. *Gargaphia* sp?

Three specimens of a form related to, if not the same as, *G. fasciata* Stal, were secured at the American Fork Cañon on June 23.

4. *Monanthia* sp?

Two forms, possibly new to science, were collected at Wasatch on June 27.

ARADIDÆ.

1. *Aradus marginatus*. New sp.

Dark brown, narrow, closely related to *Aradus affinis* Kirby; but the pronotum is much more deeply sinuated on the sides anteriorly, and the posterior lobes are accordingly more ampliated. Head long and with slender, acute lateral spines; antennæ slender, the second joint a little longer than the third and fourth united, growing a little thicker towards the tip, third joint one stage thicker, equal to the fourth, with the apical half white, fourth joint a very little thicker, fuscous, acuminate at tip. Cranium with a sunken arc around and behind the granulated, elevated, and rib-margined vertex, the neck narrowed and very distinct, rostrum fuscous, reaching between the anterior coxæ, the basal joint pale brown. Pronotum paler brown, thin, remotely granulated on the disk and forwardly, the two middle carinæ coarse beginning anteriorly in a coarse granule, anterior angles acute, postero-lateral lobes large, subangularly rounded, the posterior margin between the lobes either straight or feebly waved. Scutellum transversely rugulose, sunken at base and sunken before the tip. Hemelytra narrow, almost straight, the costal margin very feebly curved at base and paler there, cross-veins few and far apart, membrane large, white, faintly brown in some of the areoles; the cuneus and larger areoles of the corium almost hyaline. Connexivum marked with pale incisures of the segments.

Length—♂ 4, ♀ 5 millim; width of base of pronotum, 1½-2 millim.

Three specimens were collected, two at Park City, June 17, and the other at Alta, Utah, June 30.

2. *Aradus ampliatus* Uhler. Hayden, Bullet. U. S. Geol. Surv., 1876, p. 55, 6.

One specimen was collected at Alta, July 1.

3. *Aradus rectus* Say. Heteropt. New Harmony, 1831, p. 29, 4.

One specimen was taken at Alta, June 30.

Reduvioidea.

1. *Coriscus ferus* Linn. Fauna Suec., p. 962. Fieber, Europ. Hemipt, p. 161, 9.

Two specimens were secured near Salt Lake, June 13.

2. *Pagasa pallipes* Stal. Enum. Hemipt., III. 1873, p. 108, 3.

One specimen is in the collection from Salt Lake, obtained June 25.

3. *Fitchia nigrovittata* Stal. Enum. Hemipt., II, 1872, p. 79, 1.

A single specimen was secured at Wasatch, June 27. It is found also in South Carolina, Texas, New Jersey, and Massachusetts.

4. *Apiomerus ventralis* Say. Heteropt. New Harmony, 1831, p. 31, No. 2.

One Specimen from near Salt Lake, captured June 14.

5. *Hymenodectes culicis* Uhler. Trans. Md. Acad. Sci., 1892, p. 181.

Two specimens were taken near Salt Lake on June 14. Others have been collected in S. Florida, Cuba, Arizona, and the District of Columbia.

Hydrodromica.

1. *Hygrotrechus remiges* Say. Heteropt. New Harmony, 1831, p. 35, 1.

One specimen was taken at Ogden on July 3.

Saldidæ.

1. *Salda interstitialis* Say. Journ. Philad. Acad., IV, 1825, p. 324, 1.

Numerous specimens were collected at three localities visited during this trip. These were—Wasatch, June 27; Alta, June 29–30, and American Fork Cañon, June 21. The species is extremely abundant in the States east of the Rocky Mountains, and it is now known to extend from British America to Southern California, not only on the plains and river bottoms, but also on damp loamy spots in the Rocky Mountains.

2. *Salda humilis* Say. Heteropt. New Harmony, 1831, p. 35, 4.

Four specimens were taken near Salt Lake on June 25.

3. *Salda littoralis* Linn. Fauna Suec., p. 246, 915. Fieber, Europ. Hemipt., p. 147, 15.

Specimens were obtained at Salt Lake on June 14. It is a common European species which varies in about equal degree on both sides of the Atlantic ocean. As far as our present knowledge extends, it belongs to the States north of the Ohio and the Arkansas rivers, rather than to those south of that parallel.

4. *Salda polita* Uhler. Hayden, Bulletin U. S. Geol. Surv., 1877, p. 441, 11.

This peculiar and most interesting form was found by Mr. Schwarz to be quite numerous on the shores of Salt Lake, where he collected specimens on June 25. The types were obtained in the vicinity of San Diego, Cal., from which locality it was only known heretofore. The specimens from California are notable for being about twice as large as those from Salt Lake.

The exaggerated length of the antennæ and thickness of the apical joints is a marked feature of this species.

5. *Salda dispersa.* New sp.

Very closely related to *S. pallipes* Fab., of Europe, and having the white marks of the hemelytra essentially the same as in that species. The general form is also the same, but the pronotum is a little narrower, with the lateral margins less curved, almost directly oblique. This insect varies so much in the amount and distribution of the white marking of the hemelytra that no satisfactory definition can be given of its ornamentation. In general, however, it may be seen to have a broad black band across the base of the hemelytra connecting with the continuous black clavus, and thus forming the inner boundary of the large white spot behind the base of each corium. Behind this spot are several others of smaller size; the membrane has four pale cells, in each of which there is often a black streak. The cheeks are usually white, as is also the lower part of the tylus, and the inner side of the basal joint of the antennæ.

Length to tip of membrane, $3\frac{1}{4}$-$4\frac{1}{2}$ millim; width of pronotum, $1\frac{1}{4}$-2 millim.

A few specimens have the tibiæ pale testaceous, with black knees and tip, and with dark spots at variable intervals.

Numerous specimens were secured at Salt Lake from June 13 to 25. Others were sent to me from various parts of Utah, and I found the species to be comparatively abundant in various places west of Denver, Colorado.

6. *Salda explanata.* New sp.

Subelliptical, deep dull black, but lustrous when the surface is rubbed. Similar to *S. brachynota* Fieb., of Europe, but the pronotum is broader than in that species, and there is an absence of white marking on the basal part of the costa. Head and antennæ black, the latter sometimes piceous at base; the rostrum piceous beyond the base, reaching to the posterior coxæ. Pronotum nearly lunate, not deeply but broadly sinuated, with the humeral ends as wide, flat, rounded lobes, the lateral margins moderately curved, prominently reflexed, with the submargin concurrently broadly sulcated. Hemelytra a very little wider than the pronotum, with the costa wide, and acutely reflexed, corium with two or three small groups of obsolete pale specks; membrane with the areoles pale, and each marked in the middle with a black dot. Tibiæ pale piceous on the middle.

Length to tip of membrane, $4\frac{1}{2}$-5 millim; width of pronotum, 2 millim.

Specimens were secured at City Cañon, June 26, and also at Ogden and Alta.

CORISIDÆ.

1. *Corisa decolor* Uhler. Amer. Journ. Science, 1871, p. 106. Two specimens of large size were taken at the border of Salt Lake, July 4. The species was originally obtained from this same region, but the specimen were smaller and less mature.

2. *Corisa sutilis* Uhler. Hayden, Bullet. U. S. Geol. Surv. II, 1876, p. 73, 1.

Three specimens were secured at Alta, Utah, at an elevation of 10,000 feet above sea-level, on June 30. This species is common in the mountains of western Colorado; it spreads north also into British America.

3. *Corisa lævigata*. New sp.

Form of *C. interrupta* Say. Chestnut brown above, fulvo-testaceous beneath. Head broad, strongly concave, acuminate at base, face nearly parallel-sided, moderately wide, testaceous with a slender brown streak along the middle line, and two impressed punctate lines each side near the eyes, fossa of the male ovate, very shallow, reaching a little above the line of the eyes, and almost bordered above by a curved line of punctures, invested each side with silky hairs; rostrum piceous. Anterior pleural segments fuliginous pubescent, minutely punctate, sternum in all three divisions transversely black. Process of the metasternum spear-shaped, black at base. Palæ of the male broad, cultrate, bluntly rounded above at the end, the lower apical angle subacute; palæ of the female much narrower, curved, very acute at tip. Pronotum very convex, crossed by 14–15 yellow lines, which are sometimes split at and before the middle, those behind the middle growing slender as they follow posteriorly, middle line entirely carinate to base, where it terminates in a slight production of the margin. Yellow transverse lines of the clavus interrupted, the inner series zigzag or ramose and so continuing toward the apex; those of the corium also detached in short, wavy, somewhat diagonal series which become more regularly transverse and entire beyond the end of the costa; costal area testaceous, the rib and cross-vein piceous, and clouded with fuliginous, the dark color expanding upon the cubitus and forming a dark spot next the tip; veins bounding the corium blackish piceous, membrane with separated sigmoid yellow markings and about two dark clouds. Surface of pronotum very highly polished, not rastrate, base and outer portion of clavus, and most of the corium very minutely scabrous and punctate. Legs testaceous, knees of the posterior femora and borders of the posterior tarsi piceous. Venter a little infuscated around the borders and in the basal hollow.

Length to tip of membrane, ♂ 10, ♀ 11½ millim; width of pronotum, 3 3½ millim

One specimen was obtained near Salt Lake on June 13. This is a common species in various sections of the United States west of the Mississippi river. Dr. Blaisdell sent several specimens to me which were captured in fresh water near San Diego, Cal. It is found also near San Francisco, and in various parts of California, as also in Nevada, Washington Territory, and Oregon.

It differs from *C. interrupta* Say in the shape of the palæ and in the absence of rastration on the pronotum, etc.

Dr. Marx read the following communication:

ON SPIDERS' WEB.

By Dr. Geo. Marx.

About a year ago I received from the Botanical Division of the Department of Agriculture a sample of a very curious, white, flossy, silk-like substance which had been found at Vallecita, California. The postmaster who sent it wrote as follows:

"Accompanying this is a small memorandum-book, between the leaves of which you will find a strange (to me and others) substance, of which I should like to know the nature—whether it is vegetable, animal, or purely aërial. For the last five years, in the months of October and November (after the first shower of rain), I have observed this material come floating in the air (in currents of air moving from the west), and frequently and continuously for days and weeks, alighting in the roads and fields. I am situated about one hundred miles from the Pacific coast and about 2,000 feet above the level of the sea. In the middle of the day the western currents of air or wind are quite brisk, and I do not meet this thing then, but when it is calm I have caught this floating, fleecy substance in my hand, and in the morning in going along the public road I could see it lying about on the rocks and dirt quite plentiful; it adheres to everything it touches; thus in some of the samples I send you there will be found other foreign matter that the fleecy web brought along when gathered. I could not gather it with my fingers—no, I do not mean that—after I had gathered it with my fingers I could not lay it down again, because of its propensity to cling to everything touching it. This that I send was found clinging to weeds and stubble in the field where grain had been harvested. I gathered it in crossing a small field once (about fifty perches). Some of its fibres were stretched out from one weed or grass to another, as much as three and one-half feet."

The substance from California was of such a peculiar nature that it was difficult to decide upon its true character without submitting it to a thorough chemical test.

The Entomological Division rendered an opinion that it was a vegetable matter—the silk of Asclepias, while the Botanical Division, which had applied some chemical reagencies, considered it rather animal substance. Owing to the smallness of the sample, no further investigation was made, and the matter rested.

On September 20th last there fell in Florida, in localities ten or more miles apart, a similar substance in great quantities, of which I herewith present a sample.

The postmaster of Gainesville, Florida, writes as follows: "I enclose you something which has created a great deal of curiosity in our community; it was first discovered late this afternoon floating in the air or falling from the clouds. I have seen people, who live at least ten miles apart, who tell the same story—that it sometimes falls in long strands like spider webs, two and three thousand yards long, then doubled up into strands and wads. One gentleman said a colored man gave him a bunch as big as his hat, saying that his place was covered with it, and being ignorant and superstitious he was very much frightened and said it was an omen."

Mr. J. O. Andrews, of the same place, states: "I herewith hand you a small sample of a substance which fell in large quantities here and at various points in this county on the afternoon of last Tuesday, September 20th. There was first a light rainfall, and during the rain the air appeared filled with this substance, which, coming from apparently the southeast, floated gracefully downward into the trees, on the window ledges, balconies, and on the ground, in large quantities. Some of it looked like immense white spider-webs; some had the appearance of being a perfect piece of blotting-paper, and some looked like the enclosed."

Mr. J. J. Thompson, of Arredondo, Florida (about ten miles from Gainesville), also states: "For more than two weeks past a white substance streaming in long thread-like cobweb has been floating in the air when it was dry (if raining we don't know) over a large territory, ten or fifteen miles square, and settling on the weeds, cornstalks, and trees; in some places large quantities could be gathered—great handfuls and more."

The following letter, written by a correspondent from Gainesville, Fla., to our fellow-member, Judge L. C. Johnson, of Meridian, Miss., refers to the same phenomenon; the letter is dated September 21, 1892:

"Of all the curious things in nature the inclosed webs are among the strangest. Yesterday great white sheets were seen floating with the daily showers, resembling large, pure white spider-webs, some of them fifty yards or more in length. The trees in many places are covered. Near the small stream, about 100 yards from the house, some of it extended as an immense

web; in other places it rolled up into a ball. To me it seemed like the down of silk-weed (Asclepias), or the fibre of some such plant. You may have the same thing where you are, for it seems to have been general about here. I might have examined it with the microscope, but there is something out of fix about it, or I have forgotten how to handle it. This is something for your naturalists and microscopists."

The bulky sample from Florida this year allowed me to test it more carefully and I have been convinced by the thorough microscopical and chemical examination that it is a product of animal origin. This microscopic examination shows an entire absence of structure: fine slender threads rather spirally contracted appearing solid as glass rods under the microscope; not hollow, not the slightest appearance of a cell-wall, which would indicate the vegetable nature. Water contracts the specimen, the spirals being shortened and the fibres rendered more opaque.

The chemical examination showed all the characters of animal substance; it burns readily in a flame, so cannot be of mineral origin. Potassic hydrate coagulates and nearly destroys the specimen. Iodine alone turns it a yellow-brown color. Acetic acid decidedly contracts it. Zinc chloride partially destroys it and does not produce the violet color which would result were the substance cellulose; it is also rendered more opaque by this reagent. Nitric acid coagulates it, leaving only a small sediment or burned residue. Nitric acid followed by iodine simply gives the brown color of the iodine to the residue; were the substance of vegetable origin it would take a pronounced blue color with these two reagents. Phosphoric acid and iodine give the same color as the preceding; nothing of the appearance of blue. Sulphuric acid and iodine produce the same effect, though possibly not so deep a brown as either of the former; they do not give the blue color which indicates a vegetable origin. Hydrochloric acid destroys the specimen entirely. Zinc chloride and iodine give a deeper yellow color, almost a dark brown, rather than blue. It is destroyed or coagulated by hydrochloric acid, nitric acid, potassic hydrate, and by Schultz's solution. Not one of these chemical reagents destroys vegetable fibres.

The length—hundreds of yards—and the minuteness of individual threads, warrant the opinion that we have before us the product of the spinning glands of a spider, or rather thousands of spiders.

You know that young spiders are in the habit of availing themselves of their spinning product to migrate from their birthplace by floating through the air to very remote localities; if rain should moisten these weavings, they mat together, and thus become too heavy to float, and fall to the ground.

The species of spider which mak[illegible]e weavings is of course

unknown to me, but they must occur in immense numbers; perhaps they are foreigners to our country and come sailing through the air from the distant shores of the West Indies and Pacific Islands.

In the discussion of this paper Prof. Riley stated that before the chemical and microscopical test had taken place he had been inclined to consider this substance as silk of Asclepias, which had repeatedly been found in large quantities, massed together by storms. Spiders' silk when collected in quantities presented an appearance quite different from the substance exhibited by Dr. Marx.

Dr. Marx emphasized the fact that upon chemical examination the substance was found to contain no cellulose; hence it could not be of a vegetable nature. He was inclined, therefore, to consider it as a spider's web, although no remnants of spiders had been found adhering to it.

Dr. Stiles said one could not always distinguish vegetable from animal substance by chemical analysis; cellulose was found not only in plants, but also in animals, *e. g.*, the Tunicates and others. Plants, however, always presented a distinct cellular structure, and if the substance under consideration was really amorphous it must be the product of animal glands.

Mr. Schwarz said that if the substance was spiders' web it must have greatly changed by long exposure to atmospheric influences. Its simultaneous occurrence at so widely distant points seemed to indicate that it came either from Asia or Europe, where gossamer spiders were much more numerous than in North America.

The subject was further discussed by several other members, but no definite conclusion was reached.

Mr. Howard read the following papers by Mr. Townsend:

NOTES ON SOME CECIDOMYIIDÆ OF THE VICINITY OF WASHINGTON, D. C.

By C. H. TYLER TOWNSEND.

Cecidomyia serrulatæ O. S.—Two dozen or more galls of this species were found at Vienna, Va., Nov. 23, 1890, on *Alnus serrulata*. Osten Sacken describes the gall perfectly. It is whitish, hard and brittle, and has a calcareous or limy appear-

ance, as though encrusted with that material. The gall consists of the terminal bud of the shoot, which, from being stung, has hardened into a terminal bud-like gall. The whitish crust on these galls is, more accurately speaking, a brittle resinous efflorescence from the plant itself.

One gall, which was opened, was found to contain three orange-colored larvæ. It was an extremely dry and dead-looking one. This species of gall does not seem to be very common here, those that were found having been detected by careful search. It was noticed that some of them had been partly eaten into, or perhaps pecked into, by birds; at least something had evidently been attempting to secure the larvæ.

It was found the next day that a larva had left its gall and was beginning to bury itself in the earth. Most of the remaining galls were opened, but only two more larvæ were found within them, indicating that most of the larvæ had already left the galls for the earth.

Cecidomyia chrysopsidis Lœw(?)—Cecidomyiidous galls were found September 20, 1890, at Takoma, D. C., on *Chrysopsis mariana*, the terminal leaf-buds of the plant being deformed into a gall. These galls occurred in some numbers on hillsides near Takoma. Upon opening the gall, the little orange-colored larvæ were to be seen imbedded amongst the bases of the leaves in the deformed bud.

From one gall collected there issued, about September 24th, a female gnat. It does not quite agree with Loew's description, as it is not at all reddish, but almost entirely coal black. Loew's description of the gall does not seem to apply well either. Possibly there are two species of galls on this plant.

Diplosis resinicola O. S.—Three or four exudations of resin on small branches of *Pinus inops* were found at Vienna, Va., November 23, 1890. One of these, on being slightly cut into, disclosed a bright orange-colored larva, doubtless of this species.

On opening two of the others, the following day, no larvæ were found in the resinous exudation, but in the pith of each twig was found a larva of *Retinia comstockiana*. The question here arises whether the *Diplosis* originally causes its own exudation of resin, or whether it dispenses with such labor and inhabits the exudations caused by the larva of *Retinia*. Osten Sacken says nothing as to what causes this exudation, in his description of this species. No *Diplosis* larvæ were found in the two twigs just referred to, but on February 1, 1891, a dead larva of the *Retinia* was found in its tunnel in the resinous exudation of the twig first mentioned, and in the resin of which a *Diplosis* larva had been found. It seems certain, therefore, that the midges do—at least sometimes, if not as a rule—live in the resin which exudes from twigs bored by *Retinia*. I doubt if the midges ever originally

cause the flow of resin. They probably breed in such exud[...] as arise from various injuries to the tree, caused by insects, [...] or other agencies.

NOTES ON CERTAIN CECIDOMYIIDOUS GALLS ON CORN[...]

By C. H. Tyler Townsend.

On November 23, 1890, in company with Mr. Schwa[...] found at Vienna, Virginia, a large number of cecidomyiid galls on the ends of terminal twigs of *Cornus*, probably *Co[...] florida*. Some of the galls are short and oval, while others [...] very much elongated. They are all reddish in color. Inside some, which were opened, were found orange-colored larva[...] different sizes, one in each gall. Some of the galls contain[...] these larvæ had exit holes in them. In one of the latter g[...] was found a white hymenopterous larva, doubtless that of a pa[...]site. These galls were exceedingly abu[...] every spro[...] shrub, and small tree of *Cornus* which [...]e seen, in mo[...] cases every terminal twig on the bush [...]ing been stung, [...] that these gall-gnats must be very injurio[...] to the tree. On o[...] large tree were noticed a number of ter[...]inal t[...]igs not stun[...] which in place of galls bore the next [...]ear's flower-buds. [...] therefore seems that this midge stings the very spot which sho[...] produce a flower-bud, thus in some cases entirely depriving a [...] of its flowers.

There may be two species concerned in the formation of t[...] galls, the elongate gall being the work of one species, and [...] short, oval one that of the other. It may be interesting to not[...] passing, that a large larva from one of these galls was notic[...] be still very active after an immersion of one or two hou[...] alcohol.

The galls themselves are either swellings of the terminal [...] and twig together, or elongated swellings of the twig befo[...] terminus. In either case the inhabitants live in the centre, i[...] pith of the stem. This, therefore, is rather a rudimentary [...] primitive gall. In almost every case each gall had at this da[...] exit hole, even those which contained cecidomyiid larvæ as a[...] noted. A double handful were collected and taken home.

On the next day some of the galls taken home were op[...] and several larvæ were found in the elongate as well as i[...] short galls. Three larvæ were found in one gall. The exit [...] in the greater number of the galls are those doubtless of so[...] the larvæ which had already emerged to go into the grou[...] such be their habit, and not those from which any parasit[...] escaped.

On the 5th of December nearly all of the remaining galls [...] opened to determine the number of larvæ still left within t[...]

been kept in a glass jar without earth since November [illegible] elongate gall containing two small living larvæ and one [illegible]. The two living larvæ and a larger one taken from [illegible] elongate gall were put on earth, in which all three soon [buried] themselves. In one small round terminal gall there was [a] large motionless orange maggot, which was apparently [in the] pupa state. Another was found in a second small gall, [which], when put on earth, remained motionless and made no [attempt] to bury themselves.

[A se]cond specimen of the [illegible] hymenopterous parasitic larva [was fo]und in another small gall. It was active, but would not [bury i]tself when placed on earth. About 200 galls in all were [examine]d on this date, but very few of them were found to contain [cecid]omyiid larvæ.

[It is possible] there are two species among these galls, the short, round galls [freque]ntly yield the larger species, while the elongate, stem galls [prob]ably yield [illegible] species, but more larvæ live in the same [gall]. Both spe[cies] [illegible] the hymenopterous parasite were found [in th]e short, bud g[alls].

[L]ater, about [the] [illegible] of February, a hymenopterous parasite, [a s]pecies of the genus *T*[illegible], as determined by Mr. [illegible], [wa]s bred from these galls. This is [illegible] the adult of [th]e parasitic larva above mentioned.

This cecidomyiid, if it be [illegible] one species which produces [th]ese two forms of galls, does not seem to be described. It is [c]ertainly injurious enough to the [illegible] in the vicinity of [W]ashington to attract some attention and study.*

Mr. Chittenden presented for publication a paper entitled—

BIOLOGIC NOTES ON SOME SPECIES OF SCOLYTIDÆ

By F. H. Chittenden

Monarthrum fasciatum Say.—Numbers of this species [w]ere observed at Ithaca, N. Y., during the first week of June [b]oring into the trunk of a living and, to all appearances, healthy [sh]ag-bark hickory, *Hicoria ovata* (*Carya alba*). They were [w]orking through the bark straight toward the heart of the tree, [w]ith the caudal extremities of many projecting from their burrows. [A]ccompanying them, crawling about on the trunk in nearly equal [n]umbers, was a small Colydiid, *Synchita parvula*.

At Port Richmond, Staten Island, this species was again found [i]n the first week of June as before, but this time attacking a [illegible]

* Subsequent to the reading of this paper this cecidomyiid has been [d]escribed by Mr. Beutenmüller as *C.* [illegible] (Bull. Am. Mus. Nat. Hist., [illegible] v, p. 269).

cause the flow of resin. They probably breed in such exudations as arise from various injuries to the tree, caused by insects, birds, or other agencies.

NOTES ON CERTAIN CECIDOMYIIDOUS GALLS ON CORNUS.

By C. H. Tyler Townsend.

On November 23, 1890, in company with Mr. Schwarz, I found at Vienna, Virginia, a large number of cecidomyiidous galls on the ends of terminal twigs of *Cornus*. probably *Cornus florida*. Some of the galls are short and oval, while others are very much elongated. They are all reddish in color. Inside of some, which were opened, were found orange-colored larvæ of different sizes, one in each gall. Some of the galls containing these larvæ had exit holes in them. In one of the latter galls was found a white hymenopterous larva, doubtless that of a parasite. These galls were exceedingly abundant on every sprout, shrub, and small tree of *Cornus* which were seen, in most cases every terminal twig on the bush having been stung, so that these gall-gnats must be very injurious to the tree. On one large tree were noticed a number of terminal twigs not stung, which in place of galls bore the next year's flower-buds. It therefore seems that this midge stings the very spot which should produce a flower-bud, thus in some cases entirely depriving a tree of its flowers.

There may be two species concerned in the formation of these galls, the elongate gall being the work of one species, and the short, oval one that of the other. It may be interesting to note, in passing, that a large larva from one of these galls was noticed to be still very active after an immersion of one or two hours in alcohol.

The galls themselves are either swellings of the terminal bud and twig together, or elongated swellings of the twig before its terminus. In either case the inhabitants live in the centre, in the pith of the stem. This, therefore, is rather a rudimentary and primitive gall. In almost every case each gall had at this date an exit hole, even those which contained cecidomyiid larvæ as above noted. A double handful were collected and taken home.

On the next day some of the galls taken home were opened, and several larvæ were found in the elongate as well as in the short galls. Three larvæ were found in one gall. The exit holes in the greater number of the galls are those doubtless of some of the larvæ which had already emerged to go into the ground, if such be their habit, and not those from which any parasite had escaped.

On the 5th of December nearly all of the remaining galls were opened to determine the number of larvæ still left within them.

They had been kept in a glass jar without earth since November 30. One elongate gall contained two small living larvæ and one dead one. The two living larvæ and a larger one taken from another elongate gall, were put on earth, in which all three soon buried themselves. In one small round terminal gall there was found a large motionless orange maggot, which was apparently in the pupa state. Another was found in a second small gall. These, when put on earth, remained motionless and made no attempt to bury themselves.

A second specimen of the white hymenopterous, parasitic larva was found in another small gall. It was active, but would not bury itself when placed on earth. About 100 galls in all were opened on this date, but very few of them were found to contain cecidomyiid larvæ.

If there are two spec es among these galls, the short, bud galls evidently yield the larger species; while the elongate, stem galls probably yield ... species, but more larvæ live in the same gall. Both spe... f the hymenopterous parasite were found in the short, bud g...

Later, about Janu... or February, a hymenopterous parasite, a species of th... genu... *Torymus*, as determined by Mr. Howard, was bred from these galls. This is undoubtedly the adult of the parasitic larva above mentioned.

This cecidomyiid, if it be only one species which produces these two forms of galls, does not seem to be described. It is certainly injurious enough to the dogwood in the vicinity of Washington to attract some attention and study.*

Mr. Chittenden presented for publication a paper entitled—

BIOLOGIC NOTES ON SOME SPECIES OF SCOLYTIDÆ.

By F. H. Chittenden.

Monarthrum fasciatum Say.—Numbers of this species were observed at Ithaca, N. Y., during the first week of June boring into the trunk of a living and, to all appearances, healthy shag-bark hickory, *Hicoria ovata* (*Carya alba*). They were working through the bark straight toward the heart of the tree, with the caudal extremities of many projecting from their burrows. Accompanying them, crawling about on the trunk in nearly equal numbers, was a small Colydiid, *Synchita parvula*.

At Port Richmond, Staten Island, this species was again found in the first week of June as before, but this time attacking a

* Subsequent to the reading of this paper this cecidomyiid has been described by Mr. Beutenmüller as *C. clavula* (Bull. Am. Mus. Nat. Hist., IV, p. 269).

nearly healthy beech (*Fagus ferruginea*). The tree had been slightly injured, evidently by a brush fire, but sufficiently to loosen the bark and cause it to peel off, leaving about eight or ten feet of the trunk exposed. The beetles had bored into the wood in the same manner as previously mentioned, their burrows being distributed all over the exposed surface. This colony was also accompanied by Clavicorns, including many individuals of *Sacium fasciatum* and a few other species, probably attracted by the sap oozing from the burrows made by the *Monarthrum*.

I have also seen this species attacking a newly felled oak. Their burrows, which were quite numerous and for the most part on the upper side of the log, had, at the time of this observation, penetrated to a considerable distance. Quite a number of the beetles were abroad, and a few were watched as they flew and crawled about the log. Apparently they were only in search of the entrance to a burrow, which found they quickly disappeared. These were apparently already inhabited. The new arrivals made no attempt to form fresh burrows of their own.

In common with many others, these Scolytids appear abroad during the first sultry days of spring. The past year they were seen about Washington flying toward dusk early in May.

In the report of the Department of Agriculture for 1880 (pp. 274, 275) Prof. J. H. Comstock cites an instance of damage to wine-casks by this species in Arkansas. This and the two single-line notices of food-plants furnished by me for the Fifth Report of the U. S. Entomological Commission (pp. 328, 520) comprise the sum total of all the published information I am able to find on the subject. The latter note is not credited.

Monarthrum mali Fitch.—Late in May I discovered, on the Virginia side of the Potomac, near Washington, a small colony of this species boring in a stump of box-elder (*Negundo aceroides* = *Acer negundo*). The greater part of the wood was dead and dry, and it was only in the moist portion that the beetles were found. This portion appeared to be still living, the bark adhering firmly. The beetles had penetrated the bark and were boring in a straight line into the sap-wood after the manner of the preceding species. I have also specimens bred from oak fire-wood at Orange, N. J., June 6th, the lateness of their appearance being doubtless due to the wood having been kept for a long time under cover, deprived of both sunlight and moisture. This species has also been found on oak by Mr. Schwarz, who gave a short description of its galleries in an early number of the Proceedings (vol. 1, p. 48).

A summary of the known food-plants of our four North American species of *Monarthrum* would be as follows:

M. fasciatum Say—*Hicoria ovata*, *Fagus*, *Quercus*.

M. scutellare Lec.—*Quercus agrifolia* (J. J. Rivers—Bull. Cal. Ac. Sci., II, p. 66).

M. dentigerum Lec.—*Quercus agrifolia* (J. J. Rivers—l. c.)

M. mali Fitch—*Pyrus malus* (Fitch—3d Rept. N. Y., p. 8), *Quercus*, *Negundo aceroides*.

Mr. Rivers's notes concerning the two California species reads simply: "Bark of dead *Quercus agrifolia*." From this it might be inferred that specimens were cut from the bark, but there can scarcely be a doubt that these species conform to the known habits of the genus, and live in the solid wood of oak and allied deciduous trees.

Pityophthorus cariniceps Lec. is evidently a northern species and thus far quite rare, having been taken by very few collectors. At Ithaca I found a single colony under the bark of small twigs of white pine (*Pinus strobus*) August 21. A solitary specimen was taken on another occasion, also under white pine bark, in October. Only one sex, supposed to be the male, has been recognized, and the species has been previously recorded from the single specimen, from which the description was drawn (from Detroit, Mich.) and from Canada.

Hypothenemus dissimilis Zimm.—The typical form of what there can be no doubt represents the two sexes of this species were first taken by me at Ithaca in November, 1881. Eight specimens were found at one time, living in pairs, beyond question male and female, and in another case six specimens were disclosed in a single long straight gallery, all facing in one direction, toward the blind end of the burrow, and tightly jammed in, in perfect Indian file. Scolytidæ are often found thus, and in this instance had crawled together probably for warmth during the cold weather, as is so often done by other insects. The gallery from which these six specimens were taken had three branches, representing as many pairs of the insect. In all cases observed by me the beetles were found in one end of the stem and near the joint, at which point they extend their burrows transversely and irregularly. From the joints other burrows ran in straight lines through the pith and parallel with the stem. As previously intimated, this species appears to live habitually in couples, but often in company with other grape-stem borers, e. g., *Phymatodes amœnus* and *Lyctus opaculus*, all three species having been taken from a stem only an inch and a quarter in length. The specimens found were all adults, neither larvæ nor pupæ being present, although the larvæ only of the associated species were present in the canes at this time.

In my small series the larger specimens, the supposed females, are all of uniform size and general appearance. Those which I take to be the males are also uniform in size and appearance, but nearly a third smaller. The abdomen is proportionately shorter and the thorax broader than the elytra. In the supposed females the thorax and elytra are of equal breadth; the front margin of

the prothorax bears two prominent, recurved, median spines, in development about equal to those on the disc of the prothorax. In the smaller specimens, the probable males, these spines are rudimentary, taking the form of tubercles, or if sharp are much smaller than the regular discal spines. Considerable variation is exhibited even in this small series in the number, development, and arrangement of the discal spines.

Xylocleptes decipiens Lec. was taken under the bark of hickory (*Hicoria*), in its galleries, during the last week in September. A small percentage of the beetles were immature at this time. This discovery, made the past season in Virginia, near Washington, is of interest, since no record has hitherto been published of its food habits and because our other North American species included at present in this genus, viz., *concinnus* Mann. and *cucurbitæ* Lec., have entirely different habits, the former being mentioned by its describer as infesting coniferous trees, the latter, according to LeConte, inhabiting the wild gourd.

Micracis suturalis Lec., of which Mr. Schwarz informs me *M. aculeatus* Lec. is a synonym, the older name representing the male, the latter the female, was described from specimens cut by Dr. Hy. Shimer from the prickly ash, *Xanthoxylum americanum*. (Tr. Am. Ent. Soc., vol. II, p. 164), and a few notes on its habits were published at that time (l. c., p. viii). Dr. John Hamilton also gives some facts in its life-history and records its breeding in hickory (*Can. Ent.*, vol. XXIII, p. 65), and Dr. LeConte mentions its having been found by Mr. Ulke at Washington, D. C., in willow twigs (Tr. Am. Ent. Soc., vol. ix, p. xxii).

The experience quoted, of finding this Scolytid on trees of three different botanical families, suggests a long list of food-plants. I add the following: red-bud (*Cercis canadensis*), white ash (*Fraxinus americana*), black locust (*Robinia pseudacacia*), oak (*Quercus* spp.), black walnut (*Juglans nigra*), spice-bush (*Lindera benzoin*), and *Sassafras officinale*.

It is extremely abundant in *Cercis*, occurring in all parts of the tree except the largest trunks, in wood so old and dry as to be easily crumbled between one's fingers, and in decorticated trunks in just such locations as are most frequented by the wood-boring Ptinidæ. Specimens are found most numerous in the smaller limbs that have become dry and sapless. The appearance of such infested wood is evidence that the insects inhabit the same wood for several generations, completely filling it with tunnels, and undermining it somewhat after the manner of *Lyctus* and *Dinoderus*.

This species passes its entire existence from egg to imago in the wood, examination of many infested twigs having failed to show the insect in any stage under the bark. The imago sometimes, late in the fall, burrows through to the bark, but remains within the wood.

All of the galleries that I have been able to find, with the exception of those made for exit and entrance, are longitudinal, often nearly straight for the greater part of their length, but more or less undulating in places. They are quite long and I have found it difficult to trace them through their entire length, as they are so often interrupted by the burrowing of their neighbors; still, as a rule, they run parallel with each other and conflict only at the larger ends.

With regard to the development and duration of life in this species, considering what has recently been published in *Insect Life* (vol. IV. pp. 94, 131, 268), there is quite a diversity of opinion. My observations, although fragmentary, indicate the existence of only a single annual generation in nature. There is, however, the possibility of an exceptional biennial development.

The life-history has not yet been fully made out, but it has been ascertained that the imagos remain in the wood from the time they mature, which is probably during August, and do not leave it till early in April, when they gnaw their way out to light, reenter the wood almost immediately afterward and begin the work of the continuation of the species.

Under the head of exhibitions of specimens and presentation of short notes, Mr. Schwarz showed larvæ and imagos of *Silpha ramosa* which had been found abundantly last May on the dry, open prairie lands at Tenino, State of Washington. From the absence of any decaying animal or vegetable matter near these places he thought that the food of this species consists of growing plants. In this connection he pointed out that the European vegetable-feeding *Silpha opaca* occurs in North America only in the arctic and high-alpine regions, and that its reported occurrence in Nebraska and elsewhere was no doubt erroneous. In reviewing the food-habits of the genus Silpha he referred also to the insectivorous and tree-inhabiting *Silpha (Xylodrepa) quadripunctata*, and expressed the opinion that the importation and acclimatization of this and another common European beetle, *Calosoma inquisitor*, possessing similar habits, as enemies of *Ocneria dispar*, could be accomplished without great difficulties. Prof. Riley said that he had already called the attention of the Gypsy Moth Commission of Boston, Mass., to the desirability and feasibility of introducing these and other enemies of *Ocneria dispar*. Mr. Ashmead asked Mr. Schwarz whether he had noticed in Florida a carabid which climbs trees in search of prey, and Mr. Schwarz replied that the few Carabidæ peculiar to

semi-tropical Florida, viz., *Euproctus trivittatus*, *Onota floridana* and *Plochionus dorsalis*, are strictly tree-inhabiting species.

Mr. Schwarz also exhibited specimens of a staphylinid, *Amphichroum testaceum*, found abundantly this spring in British Columbia. Many specimens were seen *in copula*, and it was found that, in addition to the difference in the form of the middle tibiæ, the males have the last joint of the maxillary palpi distinctly securiform. Other species of the same genus possessed the same sexual difference, and it was evident that the genus Pelecomalium Casey which was founded solely upon this character had to be suppressed.

Mr. Schwarz also drew attention to an individual peculiarity in certain staphylinid genera with very slender terminal joint of the maxillary palpi, *e. g.*, Tachinus and Tilea. Here a specimen could occasionally be found in which the last joint of the right or left palpus, or of both palpi, terminated in a little knob or disk. No specific importance should be attached to this character.

Prof. Fernow referred to a letter which he had recently received from the director of the field-work of the Gypsy Moth Commission of Massachusetts, stating that not less than eight tons of the improved German insect-lime had been imported and that its application in the form of rings around the trunks of trees had given satisfactory results. A detailed account of these experiments would be published by the commission.

Mr. Ashmead exhibited a species of *Cratæpus* Förster,* a genus of the family Chalcididæ previously not known to occur in North America.

December 1, 1892.

The eighty-fifth regular meeting and the eighth annual meeting.

President Riley in the chair. Seventeen members present.

Mr. Frank Benton, U. S. Department of Agriculture, Washington, D. C., was elected an active member of the Society.

* Subsequently described by Mr. Ashmead as *C. fletcheri* (Can. Ent., 24, 1892, p. 309).

The election of officers for 1893 resulted as follows: President, C. V. Riley; Vice-Presidents, W. H. Ashmead and C. W. Stiles; Recording Secretary, C. L. Marlatt; Corresponding Secretary, L. O. Howard; Treasurer, E. A. Schwarz; additional members of Executive Committee, W. H. Fox, Geo. Marx, and B. E. Fernow.

The retiring President, Prof. C. V. Riley, delivered his Annual Address:

ANNUAL ADDRESS OF THE PRESIDENT.

PARASITISM IN INSECTS.

By C. V. Riley, Ph. D.

Annual addresses, such as that required of your presiding officer, usually fall into three categories—those which are in the nature of a review of the leading events of the year; those which take stock of the past work and history of the Society and are suggestive as to its future; and those which deal with some special topic having no relation to the events of the year or to the Society. Precedent in other similar societies justifies either style, and each is valuable in its way. The annual address at the close of the first year of our organization in a measure combined the three categories, but since then a marked preference has been shown for the last mentioned. Thus, for the year 1886 we had from Mr. Howard an instructive and suggestive dissertation on the anatomy, taxonomy, and morphology of the Chalcididæ, and for 1887 a study of the parasitism of cosmopolitan insects. For 1888 Mr. Schwarz gave us an admirable summary of the Coleoptera common to North America and other countries, and in 1889 treated us to a historical review of the North American publications on entomology. For 1890 and 1891 Dr. Marx followed with purely arachnological subjects, each in its way comprehensive and suggestive. I propose to follow the more common precedent and to offer you to night some thoughts upon the subject of parasitism among insects.

The most casual glance at the life upon our planet at once reveals the great extent of parasitism, both in the animal and veg-

etal kingdoms. Its manifestations are so varied in their character that the very term is difficult to define. We have the very beginnings in mere association or commensalism, and every variation from this beginning, through partial parasitism, to that most complete form in which the parasite is confined to a single host and is throughout life dependent upon it for existence. In whatever phase it presents itself, however, the subject of parasitism is of intense interest from the standpoints of morphology, biology, and evolution, as in no class of animals is the effect of habit and environment in modifying structure more markedly or graphically demonstrated. It would be obviously impossible to treat even in the most casual way of the subject of parasitism in other classes of animals. It suffices to say that parasites are found in nearly all orders of animals, from the Protozoans to the Vertebrates; that the Helminths and Bacteria are essentially parasitic, and that even the Mollusks, which are essentially non-parasitic, contain some curious parasitic forms. The Siphonostomous Crustacea (Epizoa) occupy the same parasitic place among aquatic animals as the insects do among terrestrial animals: yet I cannot treat here with satisfaction of parasitism among Arthropods generally, but must confine my remarks substantially to Hexapods.

Animals Affected.

Vertebrates.—Among vertebrates, mammals and birds are most extensively affected by insect parasites, reptiles and fishes being comparatively exempt.

Primates, including man, are very commonly affected by true lice, and not infrequently, in southern climates, by certain bots, notably *Dermatobia noxialis*. Flesh sores and the nasal passages, especially when affected by catarrh, are infested by certain Dipterous larvæ, not normally parasitic, and in some cases, as in that of our southern Screw Worm (*Lucilia macellaria*), the injury may become serious. Some of the Acarina are often exceedingly annoying, chiefly in the larva state; but with the exception of some of the Sarcoptidæ, like the itch and mange mites, they are not to be looked upon as true parasites. Carnivora are affected by true lice, by bot-flies, bird-lice (Mallophaga), and mites. They are, indeed, very susceptible to the attacks of these parasites, and the

dog harbors one stage of the peculiar degraded parasites of the order Linguatulida, the other stages of which are passed upon herbivorous animals. Domestic herbivorous animals, as every one knows, are extremely subject to the attacks of parasites, bot-flies, Hippoboscidæ, Pediculidæ, and Mallophaga combining to annoy them and affect their health, while many species have their own particular species in one or more of these groups.

The Elephant supports an interesting species of true louse of very peculiar structure, possessing a long proboscis, necessitated by the thick skin of the host. One or more mites are also found upon this animal. Bats are affected by a peculiar group of Diptera which have been separated into a family by themselves (Nycteribiidæ). The Insectivora are moderately free from parasites, but rodents are badly infested. House mice, though ordinarily free from lice, are generally attacked by mites. Field mice and rats, however, have lice peculiar to them, and are also affected by mites and fleas. Squirrels and rabbits are affected by lice and by bot-flies of the genus Cuterebra. The beaver is but moderately affected by mites and Mallophaga, but has a peculiar parasite of its own, that aberrant beetle which forms the type of the Platypsyllidæ. The Edentata and the Marsupials are singularly free from parasites, and this fact would seem to indicate that their practical isolation in Australasia had taken place before the present forms of parasitic insects had evolved.

Birds are almost universally infested with parasites of many different kinds. They are peculiarly subject to the attacks of Mallophaga, which are, for this reason, ordinarily known as bird-lice. Some true lice and some Hippoboscids also affect birds, while fleas of various species add to the list.

Very few records of insect parasitism upon Reptilia exist, and none upon fishes. Among the reptiles, turtles are know to be parasitized, while Brauer has shown that *Uperolaia marmorata* and *Cystignathus sydneyensis* are infested in New South Wales by Batrachomyia. Dr. Packard has recorded and figured a genuine Œstrid larva taken from under the skin of the back of the neck of the Box Turtle (*Cistudo carolina*). Mr. F. W. True has mentioned another case of the same sort, while I have received a Lucilia larva taken in Indiana from beneath the skin of a turtle, between the hind legs.

Among the Batrachia the Bufonidæ are occasionally found infested with Dipterous larvæ in Europe. The subject has recently received treatment at the hands of Dr. Fr. Meinert, who has described the larva of a Lucilia found in the eyes of a toad. The eggs had been laid upon the back of the head, and the larvæ had evidently made their way from that point to the eye. This was a case of parasitism of a healthy toad, but previous writers have assumed that in similar instances the eggs have been laid upon injured individuals, in sores or cancerous spots.

OTHER CLASSES.—The Worms, the Radiates, and the Mollusks are measurably free from insect parasites, though one of the marine mites, *Atax bonzi*, was found by Claparède to live within the shell of a fresh-water mussel, whether as a commensal or as a true parasite does not appear.

ARTHROPODS.—Representatives of nearly all orders of insects are affected by parasites of their own class. Aquatic insects are less affected than terrestrial, but even here there is a group of well-known water mites (Hydrachna) which attack various aquatic species. I have recorded 15 different species of Hymenopterous and Dipterous parasites reared from *Hyphantria cunea* and 14 from *Leucania unipuncta*, and these are the highest numbers recorded on any one insect in America; but in Europe, in addition to a number of Diptera, as many as 63 species of Hymenopterous parasites are recorded as attacking a single species, viz., the "Winter Moth" (*Cheimatobia brumata*). In all these cases, however, the hyper-parasites are included with the true parasites. It is usually the larva of the insect which is attacked, but both the egg and the pupa state are also affected, while occasionally the parasitized individual succeeds in attaining the imago state before succumbing to the parasite. Even the imago is sometimes attacked, and this is especially true in the Orthoptera, the attacks of Tachinids being more frequent on the imagines than on the adolescent states. Mites, especially those of the genera Uropoda and Gamasus and the larval form of Trombidium, attack many insects in all states but the egg.

DEFINITIONS.

A preliminary definition of the scope and intent of the terms used always helps—and, in fact, is often absolutely necessary—to

a clear discussion of any subject, and this is essentially true in the present case. The original Greek meaning of the term parasite, which has come down to us with little change through all languages, was "one who eats at another's table," and in etymological as well as common usage the term more properly belongs, entomologically, to the true lice (Pediculina) and the Mallophaga; for these are true hangers-on, living as degraded and dependent guests, without necessarily injuring their host. Yet most entomologists at the present day, if asked what they consider to be true or essential parasites among insects, would, undoubtedly, cite the entomophagous Hymenoptera, including the families Ichneumonidæ, Braconidæ, Proctotrypidæ, Chalcididæ, some sections of the Cynipidæ, and the Evaniidæ. Latreille's *Parasita*, as representing these and many other insects, is an invalid group and essentially obsolete.

What is true of parasites as a whole, for both the animal and vegetal kingdoms, is equally true of parasitism in insects. Parasites are not divisible into natural groups. They are found in families of various Orders, while not infrequently they occur in families, or even genera, which are normally non-parasitic. It would be folly, therefore, to attempt any natural or genetic classification.

It is equally difficult to formulate any intrinsic classification of the subject, based upon the peculiar kind of parasitism. While we find every gradation exemplified, from the most simple association, the beginning of dependence, to the most complete and absolute dependence; yet the steps in this process are often intangible and the actual facts extremely complicated. But a certain division of these parasitic characteristics as they are presented to us among insects is possible, and will be found useful. One that has been commonly used and which at once suggests itself is the division into ecto- and ento-parasites; *i. e.*, into those which are external and those which are internal feeders. These are, however, unnecessary and artificial divisions, entomologically considered, though having a certain value as contrasting the omnipresent and essentially internal entozoan and bacterian parasites with the equally omnipresent external Pediculina and Mallophaga.

Another division has been commonly accepted, viz., that into parasites proper and commensals or inquilines. It seems to me

that insect parasites may, with propriety, be somewhat differently arranged, and I would propose the following as a simple and useful working system, which will include the great majority of cases, but in the very nature of the case, not cover all the gradations:

I. PARASITES PROPER.
1. External.
2. Internal, or sub-cutaneous.

II. FATAL PARASITES
3. Internal.
4. External.
A. Similar first larva.
B. Dissimilar first larva.
a. Independent.
b. Dependent.

III. INQUILINOUS PARASITES.
5. Fatal Inquilines.
6. Commensals.

First. *Parasites Proper.*—Under this denomination I would include all those insects which are born and go through their whole life-development upon, and at the expense of, the host, and which could not exist without it. It will include two subdivisions: (*a*) *external*, embracing some of the Acarina, the Pediculina and the Mallophaga, and (*b*) *internal* (or subcutaneous), such as the various mites which produce mange or itch, or infest the passages and muscular tissue, or even the quills in the case of birds.

Second. *Fatal Parasites.*—In this division I would include the entomophagous parasites, *i. e.*, those which live at the expense of members of their own class, and, when once attached to their victims, are sedentary or immovable. The parasitism here is essentially larval, as, without exception, the parasitic life is confined to the larva state, and with few exceptions it is the larva of the host which is attacked and which, with equally few exceptions, perishes from the attack. This, again, is further subdivisible into: (*a*) *internal*, in which would be included by far the greater number of the Hymenopterous parasites, where the female parent is provided with a peculiar ovipositor which permits her to sting or penetrate the body of her victim, and

oviposit therein, and where the larva nourishes by absorption of the surrounding fluids; (*b*) *external*, or those which merely fasten to the victim and suck its juices. This would include species which may have in the female sex extremely well-developed ovipositors, as in the case of Thalessa, but which are more intended to penetrate the trunks of trees in order to reach the burrows of wood-boring insects than to penetrate the bodies of the larvæ themselves. It may be still further subdivided into those with a *similar first larva*, where the parasitic egg is fastened to or laid near the host larva, as in the case of Ophion and Thalessa and many other Ichneumonids and Braconids and the partially parasitic bees; and those with a *dissimilar first larva*, where the egg is laid away from the victim and the first larva differs essentially from the later stages, as in some of the Diptera and Coleoptera. This last category is again subdivisible into the *independent*, or those which, as young larvæ, have to seek and make their own way to the victim; and the *dependent*, or those which, by means of special facilities, cling to the female parent of the victim and depend on her to carry them to their final prey.

Third. *Inquilinous Parasites.*—In this category should be included all those guest-insects which sponge on the labors of other insects, and these, again, are divisible into those which do so at the expense of the host and those which live more or less amicably or indifferently in association with the host, without injury thereto. The former might be denominated *fatal inquilines*, and the latter *commensals*. In the former we have to deal with insects of at least four orders, and in the latter with the *Cynipidæ inquilinæ*, which take advantage of the galls produced by the true gall-flies, and with the many interesting myrmecophilous and termitophilous species which have been so well considered in papers presented to the Society by Mr. Schwarz. An illustration of commensalism will also be found in the Coleopterous genus Antherophagus, which is always found in bumble-bee nests and nowhere else.

The Parasites Among Insects.

In dealing with the subject of parasitism among Hexapods it will prove convenient to do so by orders.

HYMENOPTERA.—The vast majority of the insects which are parasitic upon members of their own class belong to the order Hymenoptera, which contains one great series, comprising several families, distinguished as Hymenoptera Parasitica. This is composed, with an insignificant number of exceptions, of parasitic forms embracing an immense number of species. So numerous are they, indeed, that although several thousand species have already been described, these are but a very small portion of those yet remaining to be described. The habits of all these parasitic Hymenoptera are in many respects identical. The female lays her eggs in, or upon, or near, the body of the intended victim. The egg hatches, and the young larva, which is a white, footless, maggot-like creature, issues, and, in what may be considered the most perfect parasitism, lives within the body of its host and bathes in its fluids, deriving its sustenance either from the blood or the adipose tissue. The host-insect is not destroyed at once, but frequently, when attacked in the larva state, is able to transform to the pupa before succumbing; yet the attack of one of these parasites is invariably followed, sooner or later, by death.

The Proctotrypid sub-family Scelioninæ, and the Chalcidid sub-family Trichogramminæ, are, so far as we know, composed entirely of egg-parasites, developing more particularly in the eggs of Heteroptera. A certain number of Chalcidids, *e. g.*, Pteromalus and Smicra, affect the chrysalis state, especially of butterflies, though here the attack is doubtless made on the larva. The majority of Hymenopterous parasites, however, infest the larvæ of other insects, and so general is their attack that, in the fall of the year, it is often difficult to get hold of a healthy larva of some of the Lepidopterous species which are affected.

In some restricted groups there is remarkable unity of habit in the same genus, while in others there is great diversity of habit. Thus the species of the genus Bassus are invariably parasitic upon the larvæ of the Syrphidæ, while the species of Pimpla may be parasitic upon Lepidopterous larvæ, upon spiders' eggs, or even upon saw-fly larvæ. The little parasites of the genus Coccophagus are invariably parasitic upon Coccids, and those of the genus Aphidius (and in fact all the Aphidiinæ) upon Aphidids; those of the genus Gonatopus always upon Tettigoniids, and those of the genus Platygaster always upon the larvæ of gall-

midges (Cecidomyiidæ). Yet in many other genera, such as Pteromalus, Eupelmus, Encyrtus, Microdus, etc., species are parasitic upon insects of very different families, or even orders. I have reared species of Eupelmus, for instance, from Lepidopterous, Orthopterous, and Hemipterous eggs; from Cynipid galls, from free Cecidomyiid larvæ, from Cecidomyiid galls, from Lepidopterous larvæ, from Coleopterous larvæ, from Hymenopterous cocoons, and from the egg-bags of spiders.

Many of these parasites prey upon each other, thus bringing about the habit which is known as hyper-parasitism, and tertiary or even quaternary parasitism must often occur, though the proof is difficult to obtain. We know, however, that in the case of the common Bag Worm (*Thyridopteryx ephemeræformis*) there is at least tertiary parasitism.

Our fellow-members Mr. Howard and Mr. Ashmead have become authorities respectively in the Chalcididæ and Proctotrypidæ, and their numerous communications to the Society have presented many facts well known to you in corroboration of these generalizations; while it would extend this address altogether too far to go further into detail as to the habits of the different genera.

COLEOPTERA.—Next in ordinal importance in the character, if not the number, of parasitic forms which they furnish are the Coleoptera, to which belongs that very abnormal family, the Stylopidæ, which was, by Westwood, made the type of a distinct sub-order (Strepsiptera). Morphologically these insects are most interesting, and, while belonging to my second category, approach more nearly to the true parasites of the first category than any of the Hymenoptera; for, except for the very ephemeral winged and independent life of the male, these insects are just as necessarily confined to and dependent upon their host in all other stages of development as are the true lice and bird-lice. The males are minute winged objects, lacking elytra, and have more or less rudimentary mouth-parts, while the females are wingless, worm-like, with flattened triangular tip, and live just under the skin in the abdomen of many species of wasps, bees, and even ants and a few Homopterous insects. A new form has recently been discovered in Africa which is parasitic upon the mole-cricket. The female Stylopid is viviparous, giving birth to hundreds of very small young which are of primitive form, with

bulbous feet and slender, hairy body, ending in two long filaments. Many of the members of the Society have listened quite recently to a most interesting paper on a species of this family of the genus Xenos, by Mr. H. G. Hubbard, from which it appears that one reason why the males in the family are so rarely seen is on account of their ephemeral nature and their short and intensive flight during the early morning hours.

To go somewhat more into detail, the Stylopid triungulin hatches within the body of the degraded, bottle-shaped female, crawls on to other wasps, and while thus moving about over the nest drops into a cell containing a wasp larva, into which it then eats its way. It soon loses legs and anal filaments with the first molt, retaining only tubercles in place of legs and becoming stationary, and nourishing on the adipose tissue of the wasp larva —without destroying this last, however. When the wasp larva has completed its transformations, the Stylops larva works its way to near the surface, generally between two of the abdominal joints of its host, and assumes the cylindrical coarctate larva state, if a male, or remains soft and larviform, if a female The male transformations are undergone within the coarctate larva, while the female is stationary beneath the chitinous body wall of the wasp. She protrudes, however, the tip of her body, which is chitinous, blunt-pointed, flattened and scale-like, and which has generally been assumed to be the head, though containing the genital opening, as Mr. Hubbard has shown.

Connecting these strange Stylopids with the more normal Coleoptera are the species of the family Rhipiphoridæ. Of the life-history of Rhipiphorus proper we know as yet comparatively little. As already recorded, I have reared *Rhipiphorus pectinatus* from the cocoons of *Tiphia inornata*, this last being parasitic on Lachnosterna larvæ. Rhipiphorus is, therefore, in this case, a secondary parasite. Both sexes are here free and winged, and while nothing is definitely known of the early larval history the probabilities are that the eggs are laid on plants or in regions frequented by the Tiphia, and that the first larva is an active triungulin and is carried into the ground by the female wasp; further, that it is an external rather than an internal feeder, and that it does not kill its victim until this last has spun its cocoon.

Metæcus paradoxus is also perfectly developed in both sexes.

According to T. A. Chapman (Ent. Mo. Mag., vol. XXVII, Jan., 1891, pp. 18–20) the eggs are laid in rotten wood in autumn, and the "mite-like young larvæ" (triungulins) are carried the following spring by the female Vespa into her subterranean nests. The next step in the larval development is unknown, except that the Metœcus larva is an internal feeder, living within the Vespa larva, which, however, does not succumb until after it has spun its cocoon, from which the perfect Metœcus issues.

Myodites, another genus in which both sexes are fully developed, has been observed to oviposit on flowers. The triungulin state has not been observed, nor is it known whether the larva lives externally or internally on its hosts, Augochlora and Nomada, from the closed cells of which Myodites has been bred.

Rhipidius (Symbius) is a curious genus parasitic upon the common cockroach, *Ectobia germanica*. Here the female is apterous and apodous, but with distinct head and provided with eyes and 11-jointed antennæ, and with subobsolete mouth-parts. The only form of the larva known resembles her in general shape of body. The female is stationary within the body of the roach, but otherwise very little is known of the life-history of the genus. The parasitism in this species would come very close to my first category, as the roach does not seem to be killed, but accomplishes its transformations. It is probable that, when more is known of the life-history of the Rhipiphoridæ, hyper-metamorphosis will be found to occur, and that in most characteristics they truly connect the more perfect parasitic Stylopidæ with the next family of Coleoptera to be considered in this connection, namely, the Meloidæ. The insects of this family, including the oil-beetles and the blister-beetles, are, in their early states, partially parasitic in the cells of bees and in the egg-masses of locusts. In the genera Epicauta, Macrobasis, Henous, etc., the eggs are laid in the ground, not necessarily near the locust eggs, though the female beetle doubtless instinctively chooses soil which she knows to contain such eggs. The first larva or triungulin is active and seeks the locust eggs. It possesses, as in all such cases, great vitality, and can live a long time without food.

In other genera, as in Meloe, Sitaris, Hornia, etc., the triungulins, after hatching, congregate on various kinds of flowers, and are carried therefrom by the female of various species of mason-

bees, especially those of the genus Anthophora, into the cells which she has prepared for her young. The triungulin is enabled to cling tenaceously by means of the triple claws, aided in some genera (Hornia, etc.) by a silky fluid from an anal spinneret; but it carefully slips into the bee-cell before this last is closed. Here it waits its time until the bee-larva is hatched, or else destroys the egg and feeds upon the bee-bread stored for the bee-larva. These beetles furnish excellent illustrations of what may be called partial parasitism; but I need not go further into details in this connection, having fully treated of the genera first mentioned in the Transactions of the Academy of Sciences of St Louis, Vol. III, and in the First Report of the U. S. Entomological Commission (1877). Dr. H. Beauregard has also more recently given us (Les Insectes vesicants, 1890) the life-histories of the genera Cerocoma, Cantharis, Zonitis, and Mylabris, besides adding many new points in the histories of Sitaris, Stenoria, and Meloë.

Hyper-metamorphosis finds its most complete exemplification in these beetles, as, after the triungulin has once begun to feed, it soon molts and the larva goes through what I have called the caraboid, scaraboid, and coarctate larval stages, each indicating increasing loss of structure, and the latter reminding us of the coarctate puparia of the Diptera. There is a subsequent free or ultimate larva, with more perfect members, from which the true pupa is derived. In Hornia we have the various transformations, after the scaraboid stage, all taking place within successively separated and inflated skins, which are not cast off or sloughed.

Finally, the Platypsyllidæ and Leptinidæ must be mentioned as parasitic families of the Coleoptera, the imagos being parasitic upon rodents, very much as are fleas and lice. It is only necessary for me to add, in this connection, to what has been published upon these curious and abnormal beetles, or to what I have presented to the Society, that the complete life-history of none of them has been yet made out. In the case of Platypsyllus, however, there was every reason to assume that, as with the true lice, it goes through its whole life-development upon its host, the beaver. Yet, from the utter failure, so far, to obtain the eggs or the true pupa, I am gradually being forced to the conclusion that both larva and imago may pass a free semi-aquatic stage, the former transforming to pupa within the ground, and the latter, after its

parasitic, blood-sucking life upon its host, ovipositing also in the ground or in the debris around the beaver dens, rather than upon the animal itself. Upon an animal like the beaver, with such a heavy and dense fur, there would seem to be no occasion for free life in any stage, and if my present surmise should prove correct it will furnish another forcible illustration of the power of heredity; for, as this brief review of the parasitic Coleoptera has just shown us, they are none of them completely sedentary upon their hosts in all stages, a result we should expect in derivatives of an order having complete metamorphoses. In other words, none of these parasitic or partially parasitic Coleoptera belong to my first category, and should Platypsyllus breed continuously on its host in all stages, it would prove a marked exception.

The species of the Staphylinid genus Amblyopinus have been found in the fur of living field-mice in South America, and in that of a living rat in Tasmania, but there is nothing further known of their life-histories or earlier stages.

I cannot leave the Coleoptera without referring to another case of partial parasitism which has been supposed to occur in the Staphylinidæ. Aleochara has been reared from certain Dipterous puparia; but, according to the latest observations we have, the habit has not been sufficiently modified to justify any other designation than that of predaceous. Mr. D. W. Coquillett has shown (*Insect Life*, III, pp. 318–319) that the young larvæ of *Aleochara* (*Maseochara*) *valida* gnaws its way through the puparium of a Syrphid fly (*Copestylum marginatum*), feeds in the same, issues as a full-grown larva, and then spins its cocoon and changes to a pupa. Whether within the Dipterous puparium it is the larva or the true pupa which is attacked, the individual is doubtless killed at once upon the entrance of the Aleochara. This could only be considered a very incomplete parasitic life, unless shown to be essential to the development of the Aleochara. In point of fact, the genus has nothing in general structure to denote parasitic life, and the recorded parasitism of *A. nitida* on Anthomyiid puparia will doubtless prove similar to that observed by Coquillett.

Thus, true parasitism in the Coleoptera occurs only in the Stylopidæ and in a few genera of the Rhipiphoridæ. In the former and in Rhipidius it is carried a step further than in any other in-

sects undergoing complete metamorphosis, since the female imago is dependent on the life of her host. Nevertheless, in no instance can Coleopterous parasitism come within my first category unless Phatypsyllus prove to be sedentary in all stages upon its host.

Diptera.—There are no truly parasitic species among the Lepidoptera, the Homoptera, or the Thysanoptera, and while in the Heteroptera we have certain species, like the common bedbug, which have acquired a pseudo-parasitic life upon warm-blooded animals, and which point out to us the manner in which the true lice have probably originated, yet the parasitism of Acanthia is a very low form not embraced in either of my categories. When we come to the Diptera, however, we find a very instructive instance of parasitism. The Tachinidæ are probably the most completely parasitic insects of the order, and from the great extent of the family (including a number of sub-families) the many genera, and the numerical abundance of the species in individuals, they rank next to the parasitic Hymenoptera in destruction to insects of other classes. The female lays her rather tough, ovoid, white eggs upon the skin of caterpillars, locusts, and other insects. The eggs hatch into white, footless maggots, which bore into the host insect and live concealed until reaching full growth, when they issue and transform, generally in the ground near by, into ovoid, brownish puparia, from which eventually come forth the adult flies. Some little time elapses after the laying of the egg before this hatches, and in the interval many insects, especially hairy caterpillars, may save themselves in molting, by shedding the eggs of the parasite with the cast skin. This, however, occurs only when the Tachinid egg is laid about the time of molting, and the vast majority of the insects attacked are eventually killed by the parasitic larvæ. The Tachinid fly seems to waste many eggs, and a caterpillar which will support not more than a dozen of the parasitic larvæ will be found sometimes bearing 50 or more eggs. As a rule, these eggs are placed in such positions that they cannot be reached and removed by the jaws of the host insect.

Miltogramma is an interesting genus of Tachinids which preys upon larvæ stored by bees or wasps. It greatly resembles the Sheep Bot-fly (*Œstrus ovis*), and also mimics the color of the sandy

soil which its victims frequent. It departs somewhat from the normal habits of the family, and exhibits to us a sort of cuckoo parasitism, differing from our ordinary conceptions of parasitism in that, by mimicry and deception, it outwits the mason-bees, by securing for its own larva the food which these more venomous creatures have stung and provisioned for their young. The victims of Miltogramma are wasps of the genera Ammophila, Oxybelus, etc. This last genus, for instance, digs chambers in sand and provisions them with other insects which it paralyzes and prepares for its young. The female Miltogramma lurks in the neighborhood of the burrow or follows the wasp therein, and places an egg or a young larva on the food thus stored by the bee.

Gymnosoma is another interesting genus of the family, which, according to v. Heyden, lives as larva in the abdomen of certain Heteroptera (Pentatomids); while the Ocypteridæ (considered a sub-family of the Tachinids by Osten Sacken) have been reared in similar fashion from *Pentatoma grisea*, and from Cassida in Coleoptera. The Phasiinæ affect also Pentatomids, and even Curculionidæ, in Coleoptera.

While the great majority of the Diptera, which are parasitic upon other insects, belong to the family Tachinidæ, there are a few others which have similar habits, as, for instance, the little gray flies of the genus Leucopis, which are parasitic upon Coccids and Aphidids. The Bombyliidæ or bee-flies must also be included among the partially parasitic species, corresponding to the Meloidæ, in the Coleoptera, in their tendency to affect the nests of bees and wasps and the egg-masses of locusts. The parasitism here, as in the Meloids, is confined entirely to the larva, which departs considerably from the typical Dipterous larva in the more complete development of the head and mouth-parts. Some of the Bombyliids are parasitic in the larvæ of Lepidoptera, especially those of certain Noctuidæ, but these are not destroyed until they have attained the pupa state. Little is known of the early larval stages of the bee-flies, and it is not at all unlikely that they will prove to be peculiarly modified and much more active than in the later stages. This possibility is indicated by well-known facts in reference to another interesting case of Dipterous parasitism, viz., in the genus Hirmoneura, in the family Nemestrinidæ. The eggs in this case are laid in clusters in

the burrows of wood-boring insects of the genus Anthaxia, and the slender, first larvæ are provided with six, leg-like, prehensile organs. They work their way to the mouth of the burrow, place themselves in an upright position, and allow themselves to be blown away by the wind, when, attaching themselves firmly to the hairs of beetles of the genus Rhizotrogus, they are carried into the ground when the female enters to deposit her eggs, where they wait patiently for the hatching of the beetle egg and for the partial growth of the beetle larva and then attack and destroy it.

In the family Conopidæ there are a few truly parasitic forms, the larvæ being found in the abdomen of living bees and wasps. One species is known in the larva state only, in which it is parasitic in the head of ants. The flies of this family may, in fact, be likened in their general parasitic habits to the Stylopidæ in the Coleoptera, except that both sexes are winged. The larva usually infests bees and bumble-bees, or even locusts, and these die only when it is about to transform. The female Conops pursues the victim designed for her young in order to attach thereto an egg or even a newly hatched larva. The egg hatches and the larva probably burrows immediately into the abdominal cavity of the host insect, since it is found in this situation when nearly full-grown. It must feed upon non-vital portions until nearly ready for transformation, and it finally escapes, in the adult form, through an opening made between the abdominal rings. The Conops is doubtless aided in its pursuit of Hymenopterous insects by its superficial resemblance to the latter, while the lengthy ovipositor of Stylogaster, of the family Conopidæ, is probably of use in attaching the egg while both parasite and host are on the wing.

Among the Syrphidæ the larvæ of Volucella are parasitic upon bumble-bees in a cuckoo-like fashion and are well known for their striking mimicry, in general appearance, of the bees they affect, and which they are thus able to deceive and take advantage of. A few of the gall-midges (Cecidomyiidæ) are also parasitic in the larva state upon Coccids and Aphidids.

In the Sarcophagidæ we have, as in the common *Sarcophaga carnaria*, evidences of partial parasitism, for, while the species usually breeds in dead or decomposing animal matter, it often attacks other insects while these are yet alive. This is, to some

extent, also true of certain species of the family Anthomyiidæ, of which the larva is known to infest the egg-masses and nourish from the eggs of locusts.

I have already alluded to the chief characteristics of the Œstridæ, or Bot-flies, in treating of the animals affected by parasites. Here, again, it is solely in the larva state that the injury is done. The egg is generally fastened by the female bot-fly to the hair or such other parts of the animal attacked as may be easily reached by the tongue, and is peculiarly constructed for this purpose and also for the purpose of releasing the larva when licked by the animal affected. In the stomach bots (Gastrophilus), and even in the sub-cutaneous bots (Dermatobia and Hypoderma), as recent researches have shown, the newly hatched larva is structurally well fitted for wandering before it finally becomes fixed for development according to the habit of the species. Here, again, we have an illustration of the persistency of habit, for on no other theory than that of derivation from ancestral forms in which the larva was more free or non-parasitic can we get an explanation of the circuitous method of reaching its sub-cutaneous abode which is now known to be employed by the young larva of Hypoderma. In Œstrus, as exemplified in the Sheep Bot, we have a further modification of the same tendency in that the ova are retained by the parent until they have either hatched or are just ready to hatch, and the young larva is placed in the nostrils of the sheep, where it can at once make its way to the frontal sinuses.

In the cases of Dipterous parasitism thus far cited it is the larva only which is parasitic, the pupa being, with rare exceptions, independent, and the imago also being free and non-parasitic.

We now come to the anomalous forest-flies and sheep-ticks (Hippoboscidæ). Here we find the normal Dipterous characteristics so modified that the insects have assumed many of the characteristics of the parasites of our first category; for while some of them are free in the imago state, others are confined throughout their life-development to the host. They have a horny, flattened body, recalling the lice in their general habits, and affect particularly birds and bats. The larva is hatched in the abdomen of the female, which is capable of great distension. There it devel-

ops until it assumes the puparium state, when it is deposited in the form of a short, white, egg-like object without a trace of articulation and nearly as large as the abdomen of the parent. Next to these are the spider-flies or bat-flies (Nycteribiidæ), which possess neither wings nor balancers, and are the most degraded and truly parasitic of the Diptera. There are also certain other wingless forms, such as *Braula cœca*, which infests the Honey-bee.

Among the Hippoboscids may be particularly mentioned the curious genera Olfersia and Lipoptena, the latter being peculiar in that in the earlier state the flies have wings and live on birds; while later they seek quadrupeds and have no further use for their wings, which are shed.

In this order (as a unique group or sub-order) I should also include the Pulicidæ or fleas, with which all are familiar and which are parasitic on warm-blooded animals, but only in the imago state. Here, therefore, it is the imago which has become modified and fitted for its parasitic habit, and not the larva. The parasitism is, however, incomplete, since some species may live upon different hosts. The fleas differ from the parasitic bugs in this, that, so far as known, the parasitic life or the need of blood from some warm-blooded animal seems to be essential to full development, while the so-called bed-bugs are known to be able to develop without such parasitic life upon animals.

HEMIPTERA.—The only truly parasitic forms in this order belong to the sub-order Pediculina, and are contained in the family Pediculidæ or true lice. These are small, wingless, and remarkably modified insects which live upon the skin of mammals and suck their blood. The eggs are fastened to the hairs of the host, and the transformations are incomplete, the young closely resembling the adults. Each species is ordinarily confined to a single host, and the few exceptions in this respect are found upon mammals which are closely allied to the original host. The mouth-parts are capable of great extension and are usually furnished at the tip with a number of barbs which serve to retain them in position. A large number of species have been described, and three commonly infest the human being.

We may pass by the Orthoptera, the Dermaptera, the Trichoptera, and the Mecoptera, as possessing no truly parasitic forms. The same may be said of the Plecoptera, the Odonata, and the

Ephemeroptera. The Neuroptera, in the more restricted sense, furnish, in Mantispa, an illustration of partial parasitism, the larvæ feeding and developing in the egg-masses of spiders and undergoing rather remarkable transformations.

LEPIDOPTERA.—Among the Lepidoptera we have a number of species which are predaceous, and others which are commensals, and the habits of some of these verge upon parasitism. Two Lepidopterous larvæ are recorded by Westwood, from India, as feeding upon the white waxy secretion of *Aphina eurybrachis* and other Fulgoridæ during the life of these insects, while in South America a small Tineid moth is recorded as preying upon *Bradypus tridactylus*, or the Three-toed Sloth, the larvæ probably feeding upon the hair of these curious mammals. A similar observation has been reported concerning a Tineid larva which feeds in the hair of living monkeys. We may, also, safely assume that the Tineids which so increase the cares of the good housekeeper have acquired their habits since man learned to weave, and that they may have taken their wool, originally, in its growing condition.

The predaceous habit, when internal and confined to some specific insect, borders very closely onto parasitism. *Euclemensia bassettella*, in the gall-like gravid females of *Kermes galliformis*, is a case in point; while *Chalcœla aurifera*, in the larva state, destroys the larva of Apis and of Polistes, transforming within the cell of its host.

PLATYPTERA.—Last to be considered among the Hexapods are the Bird-lice, or Mallophaga. These peculiarly modified parasites are placed, according to the classification of Packard, with the White Ants, Psocidæ and Perlidæ, in the order Platyptera. Brauer, however, places them in the order Corrodentia. They were placed by older authors among the Hemiptera, but belong properly with the Psocids and Termites on morphologic and embryologic grounds. The main difference in habit between the bird-lice and the true lice consists in the fact that the former have biting mouth-parts, while those of the latter are suctorial. The parasitic habit has resulted in a hard, horny and greatly flattened body, very short antennæ, large and modified legs, and a peculiarly shaped head, which, however, does not differ so much as might be expected from the ordinary Psocid type. The

eggs, like those of the Pediculidæ, are glued to the hairs or feathers of the host, and open with a circular cap at the free end. The larvæ, however, do not so closely resemble the adult insect, are less flattened, shorter in proportion, and without so hardened an integument. The species are numerous, and a number infest domestic animals and fowls, such as horses, cattle, sheep, dogs, cats, chickens, pigeons, and ducks. They are all strictly parasitic, but not so entirely dependent on their hosts as the true lice, since they do not suck blood, but live on the hair, feathers, or epidermal scales.

ARACHNOIDEA.—Among the Arachnids the parasitic species are confined to the two groups popularly known as Ticks and Mites, the species of the former group being parasitic throughout nearly their whole existence, while the majority of the forms of the latter have normally a free-living stage, many of them being exclusively plant-feeders and the majority of the parasitic species being confined to a single family, Sarcoptidæ.

The Ticks, according to the latest classification, may be included under the sub-order Cynorhæstea, and include five families, the commonest species belonging to the typical family Ixodidæ. It is hardly necessary to consider the morphological characters of the group further than to state that the toughened exo-skeleton, the flattened form, and the modified mouth-parts are admirably adapted for the parasitic life. The rostrum is of elongate form, and includes, as piercing organs, modified mandibles and maxillæ. The intricate structure of these parts has been admirably described by Dr. Marx in his annual address, published upon pages 271–287 of the current volume of our Proceedings. The species are, many of them, of cosmopolitan distribution, and infest many domestic animals. The species are not so closely confined to a single host as is the case with the true lice and bird-lice, and while there are no specific Ixodid parasites of the human animal, a number of species will attach themselves to man when an opportunity offers. The most noted of these is *Argas persicus*, which belongs to the Mediterranean fauna, and which produces serious inflammation by its bite, though developing normally on pigeons. The vitality of the species is truly remarkable, as I have had one confined without food for nearly three years, during which period it molted some eight or ten times. *Argas*

americanus has been found affecting chickens in Texas and the Southwest.

The Linguatulida are found in the air-passages of vertebrates and the nasal cavities of some domestic animals, especially dogs. Pentastomum has a remarkable life-development and is found in the liver and air-passages of various animals, especially the rabbit and the dog. Cytoleichus affects the air-passages of chickens; *Dermatoryctes mutans* affects the skin with a sort of itch, while both Syringophilus and Analges live in the quills of their feathers. Dermanyssus is a partial parasite of birds and is known to be a serious pest of canaries. The itch and mange mites (family Sarcoptidæ) are known to all, as are also Uropoda and Gamasus, so common on various insects.

Among the so-called Harvest Mites (Trombidiidæ) the adults are but partially parasitic, while the larvæ of many forms, which are six-legged, were previously considered as adults, forming the spurious family Leptidæ, and are well known in warm climates as annoyances to man under the popular names Red Bugs and Jiggers. The pseudo-parasitism in this case, however, is not an essential part of the economy of the species, and is in fact a positive detriment, since individuals attaching themselves in this way to warm-blooded animals are usually, if not invariably, destroyed, but, when attaching to insects proper, they complete their transformations. Whether such parasitism on hexapods is absolutely necessary to full development has not been proved, though it is more than probable that such is the case, just as attachment to warm-blooded animals seems essential to the propagation of the ticks. Hydrachna affects water insects in the same way that Trombidium does terrestrial species.

THE DERIVATIVE ORIGIN OF INSECT PARASITISM.

That the parasitic insects have been developed from non-parasitic forms is a conclusion which the study of them and their allies fully justifies, and there is no logical method of accounting for them except upon this basis It may be safely asserted that parasitic insects, as such, could not have existed before the animals upon which they live, and this in itself is the best indirect proof of the proposition. It may not be amiss, however, to set forth

some of the facts that furnish the strongest direct proof thereof. There is, as already stated, every gradation of parasitism in insects, from the purely predaceous or inquilinous habit through partial to complete parasitism.

The Hymenoptera furnish no parasites upon warm-blooded animals, while the Coleoptera furnish only the abnormal Platypsyllidæ and Leptinidæ, comprising but three mono-specific genera. The affinities of the former with the Hydrobiini or with Trichopterygidæ, through such forms as Limulodes, have been recognized by authorities; while those of the latter with some of the more abnormal Staphylinids, especially in the larva state, is sufficiently apparent In the Diptera, however, the Œstridæ are strictly parasitic on such animals in the larva state, with the adult state free. Now, the Œstridæ are most nearly related to the Muscidæ, among which (Compsomyia, Lucilia, Sarcophaga) a number of species have the habit of depositing eggs or living larvæ in some of the parts of the body of warm-blooded animals, either in wounds or natural openings. It is but another step for such larvæ to enter these cavities and become established there without producing immediate pathogenic conditions, and for this habit to become fixed and induce larval modifications more adapted to a parasitic life, and which affect chiefly the dermal appendages, such as the hooks or anal spiracles, the chief modifications being in the dermal spines, which are present in an unspecialized form in all Muscid larvæ. Doubtless the more primitive or earliest developed of these Œstrid parasites are those which infest the alimentary canal or nasal passages, since they occur in localities most easily invaded, and in their arval structure retain more nearly the normal Dipterous characters. The species which invade the sub-cutaneous tissue exhibit a further step in the differentiation, while those larvæ which live in the walls of the stomach illustrate the highest differentiation, with an accompanying greater modification in the character of the egg. That this has been the actual method is supported by the ontogenic facts, and the recent discoveries which I have called your attention to, regarding the early larval history and structure of *Hypoderma lineata*, acquire profound significance in this light, for they point unmistakably to the common origin of Gastrophilus. Hypoderma, etc., from an ancestral form which first acquired the

parasitic habit by entrance through the mouth. These modifications in the Œstridæ, as compared with the Muscidæ, have doubtless taken place consectaneously with the development of the mammalian type.

The frequency with which Dipterous larvæ of various families succeed in entering the air-passages or the stomach, even of man, is attested by the numerous records of the spitting up or excreting of such larva. A most remarkable fact is that some of the species appear not only to live but to be able to develop for some time in the intestinal heat of the stomach, and to be passed without injury. In the case of some of the flat-flies (Homalomyia spp.), which, living normally in putrescent animal or vegetable matter, are furnished with lateral gills, this power to live in the stomach of man is not so remarkable; but all these cases of partial and exceptional parasitic life under these abnormal conditions strikingly illustrate the manner in which truly parasitic habits may be acquired.

The Hippoboscidæ, again, show very clearly their connection with free forms, inasmuch as most species are still well supplied with wings. Some possess wings when first reaching the imago state and lose them after establishing themselves on a suitable host, while the greatest differentiation from the normal Dipterous characteristics is found in the species which never acquire wings. They are doubtless an offshoot from some of the more generalized Muscidæ, in which family we find, indeed, among some of the commoner forms, the habit of retaining the larva after this last hatches. Abnormal, therefore, as is the development of the Hippoboscids, there is every reason to believe that it is but a modification of the normal habit in the Muscidæ—a modification that has undoubtedly been aided by the fact that their chief hosts, namely, the owls, are a peculiar group of birds, essentially nocturnal, and fond of congregating in caverns and dark places.

In the Nycteribiids, or bat-flies, the differentiation or degradation has been carried still further, in accordance with their still more perfect parasitic life. This family is mostly confined to bats, the peculiarities of which, in being essentially nocturnal and in clustering in large numbers in caves and dark places during the day, would all help to produce specialization and differentiation of the peculiar parasites which infest them.

In the Hemiptera the strictly parasitic forms are contained in a distinct group, which presents well-marked characters, and sufficiently departs from the normal structure to indicate a considerable antiquity. Yet, while the relationships are somewhat obscured, there is no reason to look for their origin elsewhere than among the free forms of the order or in some generalized, non-parasitic type. The common bedbug well illustrates the general effect of the assumption of parasitic habit, and no great amount of modification were required to transform it into some of the least specialized Pediculids. Acanthia is not the only genus of Heteroptera which has a taste for mammalian blood, and the sedentary habits of the lice are easily derived from a former freer existence, and would, indeed, inevitably follow, as the general law in parasitism, whenever sufficient security from interference should accompany it.

The fact that the Pediculidæ have assumed such distinctive structure and have the parasitic habit so firmly established may be taken as evidence that they assumed the parasitic habit at a comparatively early date in the development of the mammalian animals, and have adapted themselves to their various hosts through a prolonged period.

In the Mallophaga we have a group so well defined and separated from other insects that their true affinities have educed much discussion. Their relations to the Termites and Psocidæ among the Pseudo-Neuroptera are now generally recognized, however. Many of the Psocidæ normally inhabit such places as would most readily bring them in contact with birds or mammals, and they have, indeed, been mistaken for parasitic lice and thought to be infesting fowls in chicken-houses or horses and cattle in their stalls. The Mallophaga feed upon the epidermal scales, hairs, feathers, or tegumentary excretion of the animals they attack, and, except in cases of exudations of blood upon the surface, are not supposed to indulge in blood. The Psocidæ feed rather on dead vegetal matter, though Atropos and Clothilla are not strictly herbivorous, as is evidenced by their attacks upon book-bindings, etc. (which involve the sizing and the leathery portion), and upon preserved insects. They even attack children, causing at times considerable annoyance by their bites.

We must remember, also, that many of the Mallophaga even now leave their hosts and secrete themselves, during portions of

the day, among the litter which these use for resting or breeding purposes.

In the Thysanura, which are the most generalized of all the Hexapodous insects, we have in general a decided free condition, and yet there is an example in the species, described by Mégnin under the name of *Podurhippus pityriasicus*, where the parasitic habit has been assumed. The passage from the non-parasitic to the parasitic condition is in this case easily traced, as the common species of Podura and their allies live in moist situations, feeding upon decaying animal matter, and the transfer to the feet of horses and the extension of the work here so as to affect the living tissue is a matter of comparatively slight divergence. So near are these insects to their free congeners in habit and also in structure that we may, with considerable assurance, consider that the parasitic habit has been only recently assumed.

In the Arachnoids the more constant parasitism of Dermanyssus and Argas is easily derivable from the less complete parasitism of Ixodes. Even in the strictly parasitic Sarcoptidæ there is every evidence to indicate their derivation from free forms.

Prof. H. Garman, in a paper upon the origin and development of parasitism among the Sarcoptidæ, read at the meeting of the American Association for the Advancement of Science held in Washington in August, 1891. has advanced a most interesting theory to account for the origin of the parasitic habit in this family of mites. After discussing the recent theory that the mite are descended from the true worms through such forms as Pentastomum and Demodex, and deciding that the whole class of Arachnida owes its origin rather to the Crustacea, he compares the structure of the parasitic family Sarcoptidæ with the plant-feeding families and decides that they have probably originated from the Tyroglyphidæ, a large and injurious family, the species of which feed exclusively upon vegetal matter. As an illustration of his theory of the origin of the parasitic habit, he takes for example species whose normal food is dead vegetal matter. In time of scarcity of such food, animal refuse may be an enforced substitute, or such food may occur constantly among the normal food of the species, and certain individuals may gradually acquire a fondness for it. Then, in a period of scarcity of vegetable food, those which have accustomed themselves to animal food have the advantage,

increase over their fellows, the taste becoming fixed, and a variety or species eventually arising. Supposing such a species to occur among dead leaves, and that the source of its food is refuse from the prey of carnivorous animals, there will also occur among this refuse, waste from the body of the carnivora, such as hair, fragments of epidermis, etc. If the pressure for food come to mites dependent upon this supply, it is easy to imagine them resorting to the bodies of the sleeping animals, to feed upon the loosened epidermis, instead of collecting it, as formerly, from the ground. This habit, temporary at first, will gradually become fixed, and in time the structure would change toward better fitting the mite for clinging to the skin and making its way among the fur, thus gradually becoming adapted to permanent life upon the bodies of mammalia, though still feeding upon dead tissues. From this to a habit of penetrating into the living [illegible] is but a step, and thus we have the development of a [illegible] parasitic species. This reasoning is purely hypothetical; but we have, as a matter of fact, in nature, examples of mites illustrating all the stages which have been indicated, namely, vegetable feeders, mixed feeders, scavengers, commensals, and parasites.

Effects of the Parasitic Life.

Parasitism in its broadest sense means degradation, and in its zoölogical sense fully bears out this interpretation; for the result of parasitic life through all its phases, from voluntary but yet essential dependence to the most abject and necessary dependence on the host, involves increasing degeneration. This first takes place in impotence of particular organs, followed by their gradual reduction until, in older parasitic forms, the locomotive organs have entirely disappeared and the mouth-parts are correspondingly reduced and modified. Yet, consectaneous with this reduction or degeneration of locomotive members, we find equally marked specializations of other structures, in the direction of suckers, hooks, and other features which facilitate attachment or adhesion to the host—the limbs, mouth-parts, and the dermal covering all taking part in the specialization.

The morphological characters belonging to the parasitic forms are, moreover, essentially degradational, and the tendency among

modern systematists to lessen their taxonomic significance and not to separate the parasitic forms from the larger groups from which they have evidently sprung is, in my judgment, fully justified.

The modifications due to parasitic life are very noticeable in the parasites of my first category. Changes in the form of the body are an almost invariable result, and particularly flattening, which permits of ready concealment or movement amid the dermal covering of the host, or in some cases an extreme elongation, for the same purposes. In most species, and notably in Hippoboscidæ, Pediculidæ, Mallophaga, Ixodidæ, and Acaridæ, this flattening or depression is very marked. In the Pulicidæ, on the other hand, the flattening is by lateral compression.

The direction of modification, so far as form is concerned, would [illegible] often to be fortuitous. In Pediculidæ we have th[illegible]gated species of Hæmatopinus occurring on the squirrels, a[illegible] the [illegible]ened Phthirius infesting man, while in the Mallophaga [illegible] have in the genus Lipeuris the extremely slender *Lipeurus* [illegible]*ulus* of pigeons and the broad *Lipeurus taurus* of the albatross.

The head in the Pulicidæ, Nycteribiidæ, and Polyctenidæ bears peculiar comb-like rows of teeth on the posterior margin, very prominent in Nycteribia and Polyctenes, both, though widely separated, systematically, occurring on bats. Similar comb-like spines are developed on other parts of the body, as in Platypsyllus, and they doubtless facilitate retention amid the hair or fur of the host.

The effect on the antenna is to reduce the number of joints, and in many cases to develop specialized sensory and clasping organs. In Melophagus and other Hippoboscidæ the antennæ are shortened and contained in cavities. In the Pediculidæ they are reduced in number of joints, usually to five; but in some cases (Pedicinus) to four and in Hæmatopinoides to three. In the Polyctenidæ they are four-jointed. In Mallophaga the joints are almost always five in number, but in Trichodectes they are reduced to three. They often present a number of sensory pits, or one that is well developed at the end of the terminal joint. In males of Lipeurus the third joint is elongated and apically prolonged so that the fourth joint appears to spring from near the

base of the third and to form with the third joint a clasping organ, probably connected with the copulatory act rather than for attachment to hairs.

The eyes are quite generally reduced, the ocelli usually wanting entirely, and the compound eyes reduced to a small number of facets. In Hippoboscidæ the eyes are somewhat lunate, and of a small number of facets. In Pediculidæ the facets are reduced to but one or two, sometimes apparently entirely wanting; while in Mallophaga, when present, they consist of but one or a few facets. In the Arachnoids they are often entirely wanting, and if present are extremely simple.

In the mouth-parts there is naturally a great deal of modification to correspond with the habit of procuring food. In Melophagus there is a well-developed sheath, and the suctorial tube is strong and capable of being thrust well into the skin of the host. In Polyctenidæ the rostrum is three-jointed, but in Pediculidæ the rostrum is reduced to a single joint, while the setæ forming the suctorial tube are extremely elongated, so as to permit penetration of the skin of the hosts, and this in some of the larger animals means a considerable extension. In the Mallophaga the mouth-parts are not especially different from those of Atropos or Clothilla, but the mandibles are strong, usually bi- or tri-dentate, and the maxillæ and labrum are reduced. The Arachnid parasites have either lance-like piercing or cutting mandibles or piercing and suctorial mouth parts. In Ixodidæ they are barbed and well adapted for clinging to the body of the host. In Sarcoptes the mouth-parts are fitted for cutting, and enable the mite to burrow in the dermal tissue. In Pentastomum, in the adult, the mouth-parts are reduced to mere rudiments.

The absence of wings in parasitic species is perhaps the most marked degradational character, since it unfits the animal for the mode of locomotion common to the majority of its class. But there are numerous instances where this loss occurs in non-parasitic species, and it can hardly be considered as a result of parasitism except as parasitism means, in most cases, little use for wings. Wings are present in some species of Hippoboscids, totally absent in others, as also in Nycteribiidæ, and here the loss of wings seems to follow pretty distinctly the assumption of parasitic habit and the more constant attachment to the host. In

Pediculidæ there is no trace of wings, and their loss may have been due to parasitism; but there are many non-parasitic Hemipterous insects that have shortened wings, the short-winged forms often occurring in species normally fully winged. The Mallophaga are also wingless, but they have their most nearly related species in the Psocidæ, which present many examples of rudimentary wings.

The legs present numerous examples of modification, the most striking being structures adapting the species to clasping the hairs or attaching themselves to the bodies of their hosts.

Melophagus presents a highly developed clasping organ in the tarsus. The Pediculidæ have the tarsi short and opposing the end of the tibia, but the basal joint and the claw present corrugated faces to add to the rigidity of hold, and in *Hæmatopinus suis* there is a protractile disk on the end of the tibia which, when forced outward, presses on the hair and doubtless is used to strengthen the hold on the hair. This structure very likely occurs in other species as well, but it is not easily seen in dry or prepared specimens.

The Mallophaga present two forms of legs—the one short in tarsus and with the claw fitting against the end of the tibia as in the Pediculidæ, the other long and fitted more for running than for clasping.

In the ticks and mites there is a great variety of structure in the legs, and the modifications of clasping and adhering organs are quite complex. The tarsi are often, in addition to the claws, provided with suctorial disks or sack-like organs, the purpose of which is evidently to assist the creature in adhering to its host; but in addition there are, in some species, notably *Symbiotes bovis*, suctorial organs located on the different parts of the leg, so that at almost every point the animal can make use of a sucker to ensure its attachment to its host. In Uropoda there is an umbilical thread which is partly excrementitious and which fastens to the host by a broad adhesive disk. In many cases the mouth-parts serve as organs for the attachment of the individual as well as for obtaining food, so that the means of adhering to the host animal are made very complete.

The genital organs have not, in general, undergone any very striking modification, though there are in some instances adaptations for clasping during the copulatory process.

In Hæmatopinus there are some species, *H. eurysternus* and *H. vituli*, which have on the under side of the abdomen, near the end, a pair of brush-like organs in the female, the precise function of which it is somewhat difficult to understand, though it seems probable that they are concerned in some manner with the reproductive function.

There is often great disparity in the sexes, though, perhaps, no more than is to be observed in many non-parasitic groups. In Pediculidæ the differences between males and females, either in size or form, are not specially marked; but in some of the genera of Mallophaga, especially Lipeurus and Goniodes, the difference is considerable, especially in the development of the antennæ.

In the mites the most striking difference between the sexes is, perhaps, to be found in the genus Dermaleichus and its allies, where the males are generally considerably larger and have posterior legs very greatly enlarged and apparently situated much further back on the body than in the female. Modifications in life-history are, in general, a tendency to the suppression of metamorphoses, the extreme of this being reached in Hippoboscidæ and Nycteribiidæ, but the same tendency is to be noticed in Pediculidæ, Mallophaga, and the Arachnoids, the differences between the larvæ and adult being slight.

When we come to my second category, the mode of life and the character of the parasitism differ so decidedly from any of those considered in the first category that it is difficult to discuss them from the same standpoint. The parasitism in Hymenoptera is confined to the larva state, and since the larva in insects, as I have repeatedly urged, undergoes an independent evolution, modified by circumstances which affect this state alone, the influence upon the adult is slight, and the modifications in the latter state are hardly recognizable as due to parasitism. The adults are active, highly organized insects, differing structurally to some extent from allied groups of different habit, but hardly more so than from each other. The distinctions between the four principal families, Ichneumonidæ, Braconidæ, Chalcididæ, and Proctotrypidæ, are nearly as marked as between these families and their nearest allies in the phytophagous (Cynipidæ) and fossorial series. The adults take but little food, and their chief modifications are in the reproductive apparatus. The modifications are seldom striking.

and consist chiefly in the varying length and direction of the ovipositor and in the mechanism by which this important organ is operated. There is rarely any marked modification in any other organ, though a few exceptions are to be found, such as the strangely altered tarsal joints of the females of the Proctotrypid sub-family Dryininæ, fitting these insects for the capture of the active leaf-hoppers, upon which their eggs are placed.

The larva itself is admirably adapted for its internal and parasitic life, being apodous, soft, colorless, and without specialized structure; but there is little alteration from the form common to the larvæ of many aculeate, non-parasitic species. This, at first glance, may seem strange; but when we remember that, with the exception of the saw-flies, the Hymenopterous larva is a dependent larva, being cared for by the adult in the Anthophila and in the Heterogyna, or hatching in situations where it finds its food already provided, as in the fossorial families and the Cynipidæ, the similarity is accounted for. In short, the typical Hymenopterous larva in the Aculeata is a dependent creature, well housed and cared for, and these are the steps from which parasitism is easy and which have brought about similar loss of color and structure.

The mouth-parts show the principal variations, those of the parasitic series being fitted for piercing adipose and connective tissues and absorbing fluids. The mandibles are acute, unidentate and falciform. The eyes are represented by simple pigment spots. The antennæ are almost lost and the palpi are rudimentary. The alimentary canal has also become profoundly modified in many of the species, especially in the smaller forms which live gregariously within the host and which are bathed from birth in its blood or softer tissues and absorb their nourishment, especially in early larval life, chiefly by a kind of environmental digestion. Thus we see that in the parasitic Hymenoptera the modifications even of the larva are similar to those which have taken place in the larvæ of non-parasitic forms but which live under somewhat similar conditions. On the whole, therefore, modification from the parasitic habit has been less in the insects of this second category than in those of the first; yet, no doubt, future investigation will teach us that more of the characteristics of the adults in the parasitic series, than we now imagine, have resulted from the parasitic habit.

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